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Notes on Pipe Founding.*

By S. GROVES, M. E.

The subject of "Pipe Founding" has not, hitherto, received the attention it deserves. Water pipes are a necessity in every city and township in the civilized world. Indeed, one could almost take the number of pipes made and sold, as an index of the material progress of a country. As young communities develope into highly organized populous cities, the village millwright, with his primitive

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cistern, ancient well, and old-fashioned hand pump, is displaced by the civil and mechanical engineer, with their colossal pumping stations, extensive filter beds, broad reservoirs and branching street mains, through which a copious supply of water can be had at any moment, in the very homes of the people. And since the modern tendency is towards the formation of great cities, the question of an adequate water supply for the dense populations will be an ever-increasing problem, and water pipes will be more and more in demand.

The United States census of 1890 gives the consumption of pig iron in the pipe foundries alone, as 590,000 tons; the estimated value of which, when converted into gas or water pipes, would be at the least $10,000,000. In view of the magnitude of this important industry, it is a matter of astonishment that so little has been said or written technically on this special branch of the trade. With the exception of a fugitive article in some illustrated magazine, or journal, intended to show, perhaps, what a striking analogy there is between a pipe foundry and a bee-hive, very little has been made known to the uninitiated. Only one book has been published on this theme during the last ten years, viz., Macfarlane's "Practical Notes on Pipe Founding" (1888), dealing exclusively with his own mechanical system of making large pipes, i. e., 16 in. to 48 in., and since pipe founding in a practical form has never been discussed before either the National, or Local Associations, it has been deemed opportune that I should read from my note book some of the facts and data gleaned during a twenty-one years' experience in the practical manufacture of vertical pipes, in one of the largest and best equipped foundries in the world.

It is just possible that the data I shall present may be deemed antiquated by experts here, but my object to-day is not to introduce anything singular, or anything new technically; nor, do I hope to exhaust the subject, but simply venture to address you on this theme, in the hope that some of the data presented may, by the association of ideas, lead you to have a still more exalted opinion of the importance and dignity of the iron founders' business.

SOCKETS DOWNWARDS.

I may be permitted to say at the outset, that one of the chief points of difference between European and American practice is,

* Paper read before the Convention of the American Foundrymen's Association at Detroit, May, 1897.

that in the former, the almost universal custom is, to cast the sockets downwards; while in this country we cast the sockets or hubs at the top. After an enquiry into the reasons assigned for the casting of the pipes with sockets upwards, I confess that these reasons do not seem to be so cogent as are the arguments adduced for the European custom; for, if there is one part of a pipe where the metal should be close and solid, it is at the socket end—especially at the shoulder; and the pressure of the whole weight of the body must of necessity help to press the molecules of metal at the bottom into closer juxtaposition; and, moreover, tend to keep that part of the pipe clean, since the scoria and impurities in the metal will naturally rise to the top. It is admitted a simpler, and hence, more economical process for the iron founder; but the chances of defective section due to the causes indicated, are much greater than by the socket down system.

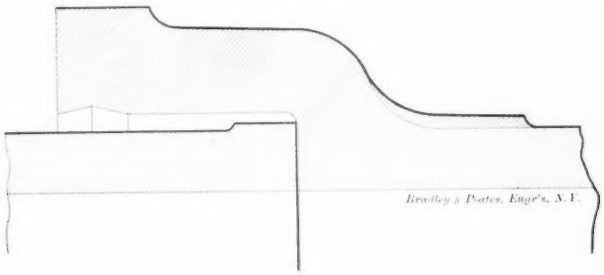
INEQUALITY OF SECTION.

Another innovation which strikes an observer interested in pipe founding is the general abandonment of the belt below the shoulder, or socket. Now, the original reason for designing the sockets in that way was, to aid shrinkage, by making the transition from the thin body to thick shoulder gradual; and it is not to be wondered at that many of the pipes rejected by the inspectors are so rejected, because of defects at the socket, i. e., granular, spongy, porous—sometimes the sockets separate from the body, whereas, if the section had been gradually increased, instead of changing abruptly, the shrinkage would have been uniform. And I may remark in passing, that this fault of unequal sectioning, is not confined to the designing of pipes, but to every branch of founding. I venture to assert, that one-half the shrinkage troubles in the foundry arise from this cause. If the engineer and the draughtsman in preparing plans, looked more to the equalization of section, there would be far less trouble with castings in the foundry.

MODE OF MANUFACTURE.*

Pipes 1 ft. to 2½ ft. diameter are usually cast on banks, at an angle of about 30 deg. They are molded in cast iron, barred, drag and cope flasks, from complete iron patterns, carefully turned and scraped, and cores made with hay ropes and loam upon hollow perforated or solid fluted wrought iron bars.

Pipes 3 ft. diameter and upwards are cast vertically in pits; the flasks for the smaller sizes being fixed; the larger portable. In some foundries the pits are radial slots in the shop floor, the island at back having a jib crane to swing the radius of the pit; in others, the pits are circular—about 20 ft. diameter and 8 or 9 ft. deep, having as many as 50 fixed flasks, and a hydraulic double jibbed crane in the center, thus controlling the two halves of the pit without having to swing the whole circuit.



Belted Socket.

Fig. 1

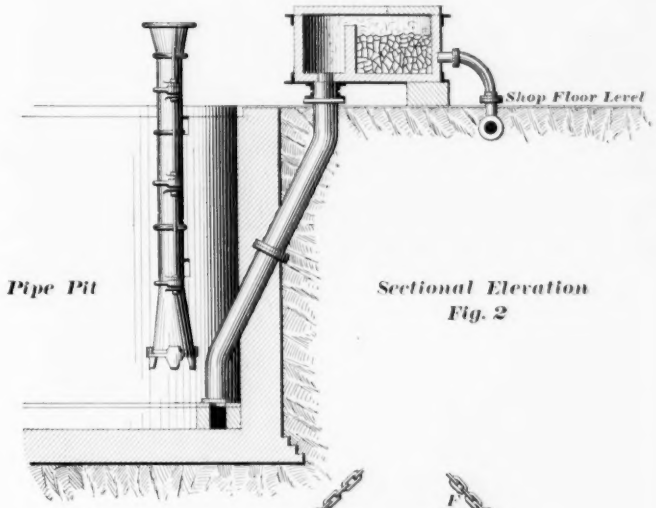
One of the best equipped shops for making pipes from 3 in. up to 9 in. diameter in 9 ft. lengths, was designed with oval pits. Each pit would turn out 80 3 in. pipes a day.

Let me now describe the various operations involved in the manufacture of say a 3 in. pipe, 9 ft. long. In the first place we have a flask fixed in the pit wall, with the

* Mr. Groves illustrated the reading of his paper with blackboard sketches, from which the illustrations appearing here have been reproduced.—ED.

halves hinged together. These are secured by clamps, if the concern is conservative, or by an eccentric locking device if the plant is modern.

A turned socket pattern is secured to bottom of flask, then the turned iron body pattern is lowered into flask and fitted into socket pattern. Green sand is then thrown into the mold and rammed from above, either by hand or machine. When the mold is formed up to the top, the body pattern is withdrawn and socket pattern disconnected.



Sectional Elevation
Fig. 2

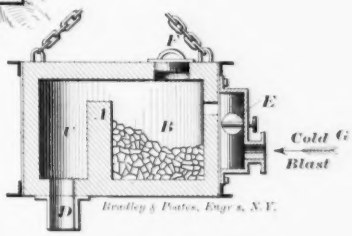
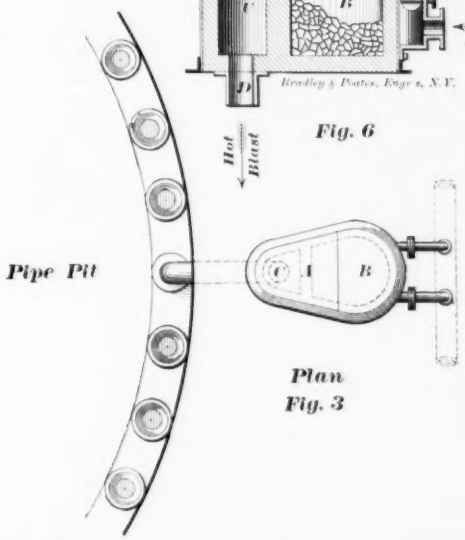


Fig. 6



Plan
Fig. 3

COATING.

The interior of mold is then coated with liquid charcoal blacking, either by means of a long swab of flax, or by means of a special valve.

The swab leaves streaks, but the valve shoots an even stream down over every part of the mold. Surplus liquid is caught in a box below and used over again.

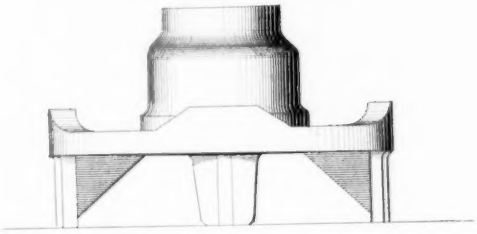
DRYING THE MOLD.

The mold has now to be dried. Various devices are in vogue for this work. I will de-

scribe two with which I am familiar. Since the boxes are fixed in the walls of the pit, it is necessary that the drying apparatus be adapted to this condition. A hollow chamber is therefore made round bottom of pit (see figs. 2 and 3), consisting of brick work covered with a cast iron plate, having holes cast in underneath each pipe flask. Hot air is delivered into this chamber through cast iron pipes from a portable stove located at top of pit. (See figs. 2 and 3.) This device has been patented in Germany in recent

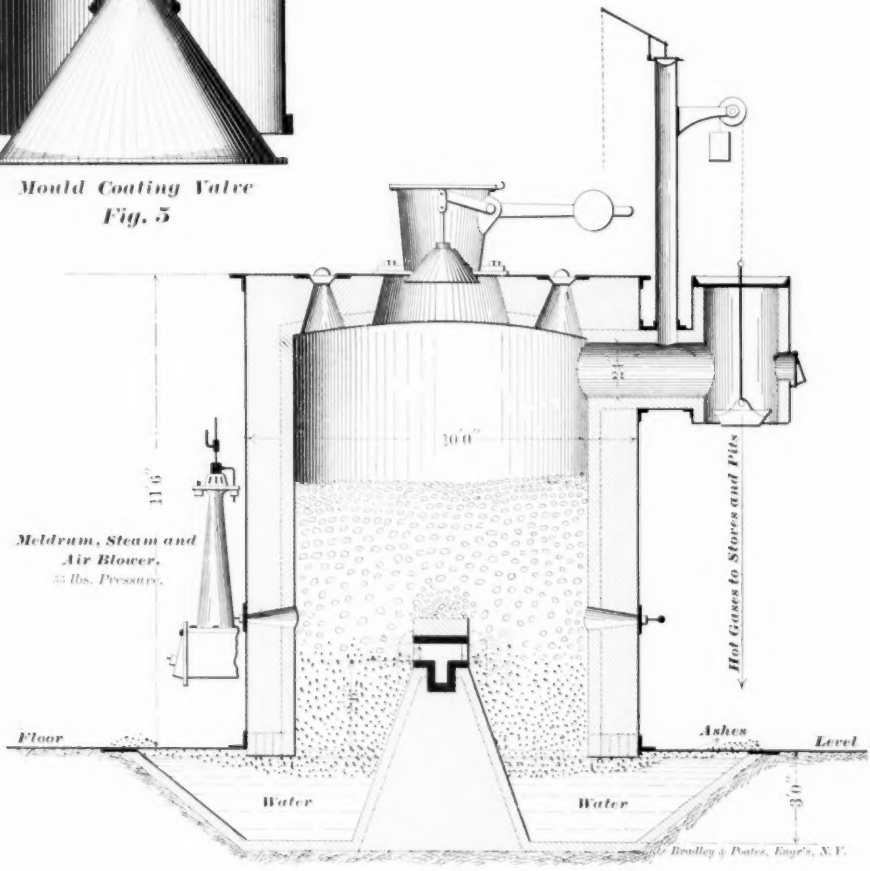
Mould Coating Valve

Fig. 5



Socket Pattern.

Fig. 4



10 CWT.

Continuous, Grateless, Water-seal, Gas Producer.

(Snowdon)

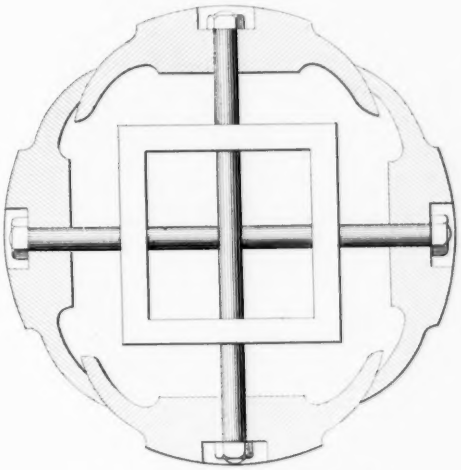
Fig. 7

years and was exhibited at the World's Fair as a modern invention.

During our visit to Philadelphia last year, I observed that one progressive firm was using this stove in a portable form, for skin drying molds in their jobbing shops, carrying it around first to one mold and then another—the fan blast being operated by a small motor.

GAS PRODUCERS FOR DRYING.

A still later and better arrangement is to locate outside of foundry one or more gas producers (fig. 7), from which the produced gas is conveyed through cast iron mains to the various pipe pits, for drying the molds. I have seen this system operated in a large foundry with complete success; and it has the advantage of keeping the fumes from

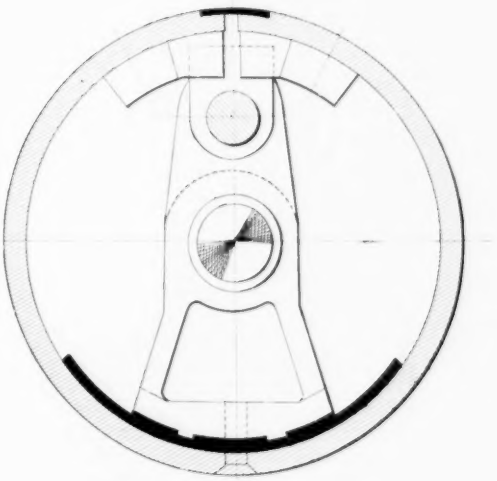


Segmental Collapsing Core Bar.

Fig. 8

Spring Collapsing Core Bar.

Fig. 9



Spring Collapsing Core Bar

Fig. 10

the fuel outside the shop—greatly to the comfort and health of the workmen, who have a hard time of it in a pipe foundry, under the most favorable circumstances.

MAKING THE CORES.

Having described the mode of preparing and drying the mold, we now pass on to the making of the core. We first come to the core barrel, in the perfecting of which much ingenuity has been expended. The barrels for small pipes are made solid fluted. Often the body is made of a perforated wrought iron tube, having cast iron spiders with journals at each end. This made a very iron around the core shrinks, it would be impossible to withdraw the barrel after the pipe has cooled off. When medium sized pipes are cast, even with the hay ropes, the barrels refuse to come out. Hence it is that much thought has been expended in the designing of special core bars, whereby the trouble caused by the gripping of the barrel can be avoided by mechanical appliances.

One of the best barrels with which I am acquainted is the collapsing barrel, invented by Mr. Henry Cochrane some 30 years ago. (Fig. 8.) It consisted of four segments, having square spider inside, upon which were

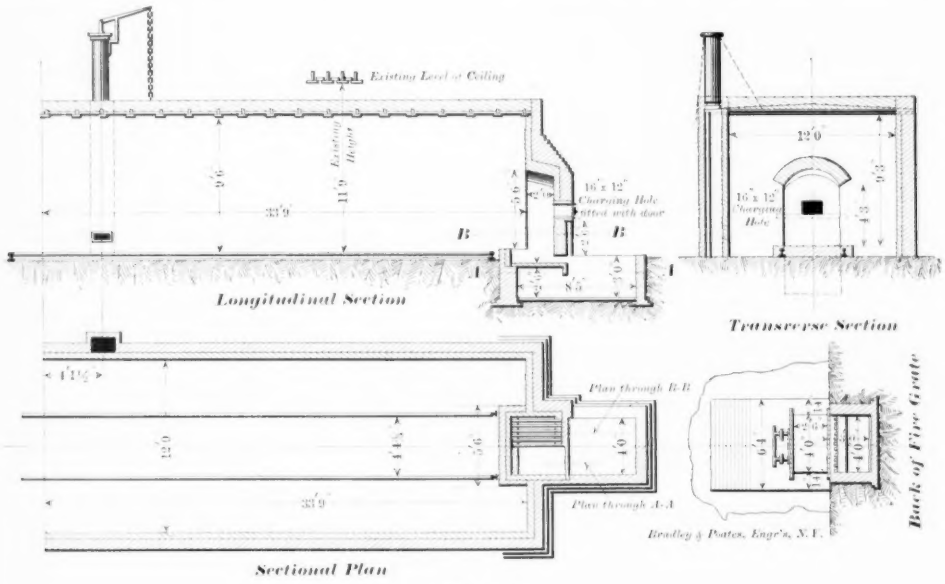
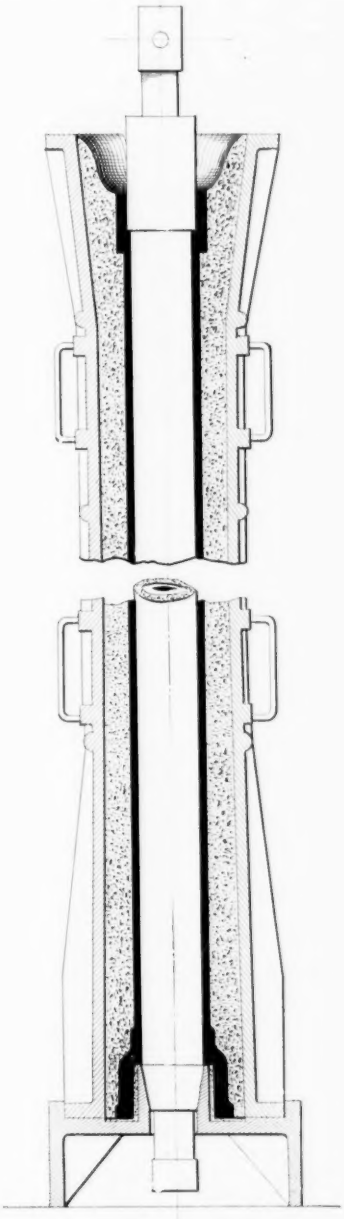


Fig. 11

light bar, but the trouble was, that the rough handling they receive at the hands of the cheap labor employed, soon damaged them, and made them out of shape, hence the common practice for the smaller cores was to make them of cast iron perforated pipes, around which, after being coated with clay wash, hay ropes were twisted and then covered with wet loam mixed with horse manure and clay wash.

It is unnecessary to dwell upon the necessity for using the hay ropes since every foundryman knows that it is intended to burn when the pipe is cast, causing a hollow space between the coating of loam and barrel. Were it not for this device, after the cast wedges fitting into guides cast on each segment. This central spider was moved in and out by means of a screw at one end, which either forced the wedges into the guides, expanding the bar, or withdrawing it, and thus collapsing. Before the hay bands and loam are put on the bar, it is expanded, and no sooner is the metal set in the mold after casting, than the screw is operated, wedges withdrawn, barrel collapsed, and lifted freely out of the flask, and cooled off with clay wash, ready for another core making. These bars were almost perfect for their purpose, but the operating mechanism being of necessity very delicate, they were continually being broken, consequently were

costly appliances. The percentage of breakage, however, was reduced to a minimum.



Section of 4" Pipe Mould: With Core in Position ready for Casting.

Fig. 11a

by casting the various parts with a metal mixture containing from 10 to 15 per cent of steel—punchings from the best boiler plate.

But admirable though these segmental collapsing bars were, for pipes ranging from 6 in. up to say 24 in., they were altogether too costly for pipes above this, so another bar was designed, much simpler in construction, cheaper in manufacture, and equally effective in operation.

A perforated cylinder was cast, then put on the planer, and three-eighths of an inch planed out of one side, the whole length of the barrel, cast iron brackets were securely bolted into each end, having turning spindle in center and sliding bars at top, with wedges cast on at various stages, fitting into guides bolted at shell, the slot being covered with a wrought iron plate.

If a core is about to be made (fig. 10), the nut is turned by means of a box spanner, which draws the bar forward, opening the slot to about 1¼ in., making the barrel oval, but this irregularity is overcome, by a coating of loam and horse manure. Forty-two inch pipes now lying underneath the streets of Montreal, were made with core barrels of that design.

DRYING THE CORES.

The cores are placed on rack carriages, run into the core oven and dried, then brought out, coated with black wash—pulverized charcoal and clay wash—then put into the oven again for final drying.

The mode of heating the ovens with which I was familiar was, in one plant, by means of a coke fire. In another well-ordered establishment the ovens were heated by producer gas—from the same producers which delivered hot air or gas to the pipe molds in pits.

The molds and cores having been prepared, a kellet, or core bar seating, swept in loam, is bolted to the bottom of flask, and core lowered into same.

A dry sand cake ring is then inserted at top of mold, runner gate of green sand prepared, and everything is ready for pouring.

In one first-class pipe foundry I know of, the metal with which the larger pipes are cast, is run directly into the ladles from the blast furnace, and very excellent results were obtained in the shape of strong, clean metal. Phosphorus is the bane of the steel manufacturer, but a high phosphorus iron is just the thing for pipes, since it is an excellent preventive of oxidization. A good

ladle (fig. 12) used by some pipe foundries, is spoken of very highly. It has a division in the middle which keeps back scoria and dirt. The principle of taking metal from bottom of ladle is a good one, and is adopted by most steel plants.

When pipes have become set, core bars withdrawn and newly cast pipes have become nearly black on the body, and grey at the socket, they are lifted out of the flasks and cleaned, care being taken to leave no patches of sand on the outside, for, in the cooling, the molecules of metal arrange themselves in an imaginary line around the sand patch, due to difference in rate of cooling; and instances are on record where such defined patches have blown out a long time afterwards; they are then rolled on iron

Section of Divided Ladle.

Fig. 12

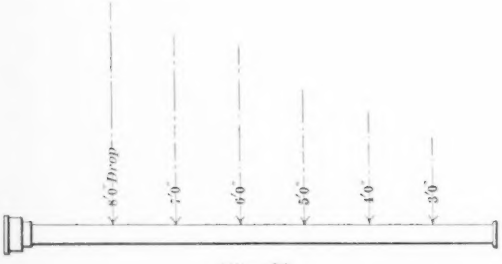


Fig. 13

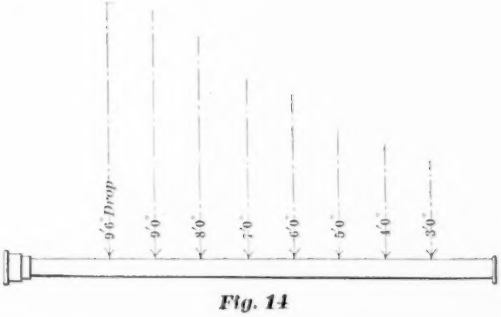


Fig. 14

gangways down to the hydraulic testing apparatus, where, if it is a 12 in. pipe, pressure is let in from the street main, and then hydrostatic pressure up to 300 pounds per square inch is applied by gauge.

HAMMER TEST.

The inspector then takes a 1½ pound hammer, and while the pipe is under hydraulic pressure, strikes a series of blows along the body. This is one of the most dangerous and hurtful practices known in the trade. Many a pipe which would not leak prior to the blows, has become chronically defective afterwards. In 1889 I concluded valuable experiments, which demonstrate this. A 4 in. pipe, 9 ft. long and ⅜ in. thick was placed in the hydraulic testing machine, and subjected to a water pressure of 260 pounds per square inch, and while under this bursting strain, a ball 1½ pounds was let fall upon a chalk line mark on body of pipe, at given points and varying heights. The pipes

Fig. 15

were then taken out of the press, and broken longitudinally into two parts, when a remarkable phenomenon was revealed. On the inside of each pipe, at the points where the ball had struck upon the chalk line, was a star-shaped fracture. (Fig. 15.) The fractured half of each pipe was then broken into two parts, and each piece upon which a blow had been struck carefully broke through the star-shaped fracture; to our astonishment, we discovered in each section, an oxidized fracture penetrating through the inside skin of the pipe into the body metal. (Fig. 16.) In no case was the depth less than 3-32 in., the greatest being 5-32 in.

The striking of any hollow castings which have to be subjected to high pressure, is a dangerous custom, and doubtless many a good casting made in the jobbing foundry also, has become defective through the violent use of heavy hammers, or ends of crowbars, in the effort to jar out internal sands, core irons, etc.

GAUGING.

And not only are the pipes proved by a hydrostatic pressure, but are carefully gauged, to ensure standard diameters, even thickness, etc. It is said, upon good authority, that one-third of the pipes cast in an average foundry are condemned by the inspectors representing the purchasers.

SIDE BULGING OF PIPES.

Speaking of inspectors, I remember an important contract for large pipes, 54 in. diameter, 1¼ in. thick. Before entering the hydrostatic press, they were gauged by a bumptious inspector as to diameter, and he reported that the pipes were all oval, and sure enough, upon measuring inside at spigot end, it was found that the horizontal diameter was considerably larger than the vertical diameter. Then began theorizing as to the cause, and all was excitement. But a workman with quick perceptive powers, quietly suggested that the pipe be measured ver-

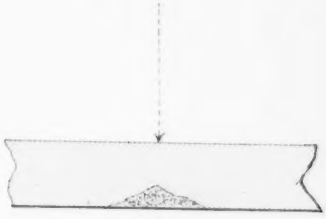


Fig. 16

tically and horizontally, carefully marked and rolled a quarter turn. This was done, and to the astonishment of everyone, the vertical diameter now became the same as the first horizontal, and the horizontal the same as the first vertical. The pipes had simply bulged sideways with their own weight.

COATING.

The pipes having successfully passed the gauging of the inspector, and hydrostatic test, are now conveyed, or rolled, into a hot oven, where they are heated to a temperature of 420 deg. F., and immersed in a bath of coal pitch varnish, consisting of two parts tar to one of gas oil. The best preparation is made in accordance with Dr. Angus Smith's formula, invented some 30 years ago. This varnish is not only a preventive of rust, but hinders tubercular accretions and is at the same time an excellent antiseptic. It is mainly in this matter of coating that cast

iron pipes have so far generally withstood the strenuous effects of the structural steel and iron manufacturers to run in the built pipes, and run out the good old system of cast iron for water mains. No cement or varnish has yet been discovered, which will not peel off a steel or wrought iron pipe after being buried in the earth for a considerable time. The hard polished scale on the steel and wrought iron plates, due to rolling, prevents the adhesion of coal tar varnish, while all other cements, etc., have proven, under careful tests, to be physically injurious.

CONCLUSION.

From the phenomenally low prices at which pipe contracts are taken in these days, it might be inferred that the manufacture is correspondingly unimportant, involving little skill and resource. To reason in that way would be a great mistake. Very few jobbing foundries are equipped as yet with tensile and transverse bar testing machines, but every pipe foundry in the country is forced to have a complete outfit in this respect, since all pipe contracts are let on conditions not only of accurate gauging, and hydraulic pressure tests, but from the same metal from which every day's cast is made, specified tensile bars, to withstand a breaking strain of 14,000 to 18,000 pounds per square inch, and transverse bars, 2 in. by 1 in. section laid flat on points of support 2 ft. apart must carry a load of 1,900 pounds, with a deflection of 5-16 in. before breaking, are insisted upon. These severe measures of protection are necessary, when it is known that the bursting of a street main has caused $10,000 damage, through cellars being flooded and merchandise damaged before the main valve in the section could be closed. A transverse test is essential, owing to the heavy loads which pass over the ground, under which are laid heavy water mains; therefore, the pipes must be able to stand severe shocks and transverse loads. It is remarkable what a heavy transverse load even small pipes will carry without breaking. In 1885 I conducted some interesting experiments; a series of pipes were placed horizontally upon rests 8′ 6″ apart, and a load applied on the middle. The following is a tabulated record of the results:

Date.	Diameter of pipe.	Weight of pipe, lbs.	Weight applied at middle, lbs.	Deflection.
Feb. 18, 1895.	8″	431	11,144	4 29-32″
	7″	336	7,896	4 7-8″
	5″	237	3,916	4 7-8″
	4″	175	2,296	4 13-16″
	3″	133	1,400	4 3-16″

With these facts, I must draw to a close my necessarily superficial and imperfect sketch of the great industry of pipe founding. Although trained to the profession of mechanical engineering, my warmest sympathies and inclinations are towards the foundry. I believe it is in the blood, for I come of a race of foundrymen; and I shall be glad if my contribution this day leads anyone here to have a still higher regard for, and take a deeper pride in, the business of iron founding.

Casting Brass Bearings.

The manufacture of brass machinery bearings is a trade by itself. Yet the average foundryman is often called upon to make these bearings. Each man has his own particular method of making these bearings, and if they come out all right, then the method is correct. But in many shops the bearings do not finish as they should, because of incorrect methods of combining the copper and zinc; also because of crude methods of casting.

Mixing.—In making the mix of metals for casting brass bearings, I aim to combine the copper and zinc in such a way as to insure a perfect alloy of the two metals, and volatilise as little of the zinc as possible. As the outfit used is of special construction, the drawings are presented in explanation.

I first put the copper into a crucible, and melt over a coke fire, as shown in the sectional view of the furnace in Fig. 1. The furnace is of ordinary build, except that the melting vessel is balanced on a pivot at B, and the latter bears in a box in the cross piece C. The cover of the vessel is lifted by a worm shaft provided with the turning wheel A.

After melting the copper I combine it with the zinc on lines of my own devising, using an apparatus such as is shown in Fig. 2, thus averting that well-known trouble

caused by adding comparatively cold zinc to a body of molten copper, which usually causes the copper to "set." I thoroughly warm the zinc so as to expel all moisture, then put it into the crucible shown in Fig. 2.

This crucible is in a brick-lined wooden case, and the space between the sides and the crucible can be packed with burning charcoal, thus making a hot bed of fire. On the top of the charcoal is a layer of sand. This keeps the heat in. A spout is placed at C, through which the gate leading to the crucible is put, as shown. The copper can be poured by removing the cap.

The crucible can be lifted out by the rings D, D. The proportion of copper put in will, of course, be governed by the desired ductility of the brass. The greater the amount of copper the softer the metal will be. Zinc hardens the alloy, and tin may also be added to make the brass more brittle. In introducing tin, drive out the moisture by warming, otherwise steam will form and cause an explosion.

Adding Aluminum.—Aluminum seems to give extra fluidity to the metal, which allows the making of clearer and sounder steel castings, and is now used in small proportions. In the manufacture of brass bearings aluminum may be added in small pieces of from ¼ to ½ lb. weight to the ladle during the tapping operation. The aluminum melts instantaneously, as the temperature of the molten copper and zinc is above the melting point of aluminum, and it seems to diffuse with remarkable rapidity throughout the entire contents of the ladle.

The 5 to 10 per cent of aluminum bronzes are very dense, fine-grained and strong alloys having good ductility as compared with the tensile strength. The aluminum unites readily with all the copper and zinc metals. Alloyed with aluminum in proportions from 8 to 10 per cent gives added strength and rigidity to castings as well as sharpness of outline, with a decrease in the shrinkage of the metal.

Casting.—We now get to the process of casting the metal. A sectional view of the equipment I use is shown in Fig. 3. The bottom end of the core barrel has a collar H shrunk on, which forms a seat for the core on the hub. There is a solid stub welded in the end of the core barrel, with taper end, and thread on same for the nut. The core barrel consists of a cylinder of the size required for the interior of the half to be cast. The cylinder is perforated to allow the gas to escape from the core while the half is being cast. I take the molten metal to this mold in a cylindrical retort C, and in which is little more than enough metal to cast the bearing. This retort is in a cast iron case A, and packed with burning charcoal B. Upon adjusting the outlet of the retort to the pouring gate E, I withdraw the plug D, which reaches through to the bottom outlet, and the metal quickly enters the mold. The pouring gate cuts into the mold about half way down the neck and is set at an angle so as to cause a whirl or rotary motion to the metal while it is being poured. I have got out some satisfactory brass bearings in this way, and do not have to contend with diffi-

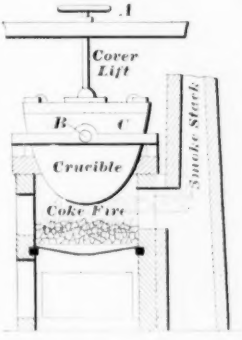


Fig. 1

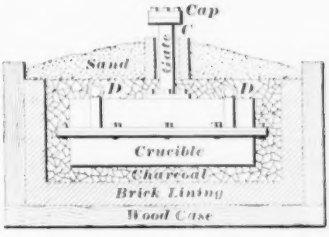


Fig. 2

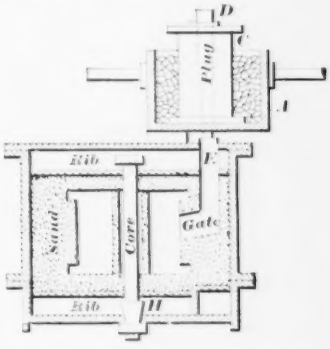


Fig. 3

CASTING BRASS BEARINGS.

culties caused by oxidation, scumming, etc., that troubled me in some of the methods formerly tried.—F. A. Farnsworth in the Iron Age.

(We should very much like to know where one of these furnaces as shown in Fig. 1 can be seen in operation, and we shall also be indebted to Mr. Farnsworth for the address of the manufacturers who make such crucibles as shown. We would also most respectfully call the author's attention to the fact that it is an absolute impossibility to melt copper in the manner he has illustrated. Applying a waste heat to the bottom of the crucible is at least not economical, and it is the first instance we have known where a crucible is placed above the flue leading to the chimney and largely outside of the furnace. Perhaps Mr. Farnsworth has an idea whereby we may be able to melt iron in a cupola above the charging door. He can do this if he can melt copper as shown in illustration No. 1.

Of course his idea of lifting the cover (weighing about ten pounds) by a worm shaft, may be all right, if people choose to kill time that way; however, he should have shown in the illustration a hose to be connected to the nearest hydrant for cooling the man who is going to operate the wheel. Anyone who has bent over a brass furnace knows that the spot A in Fig. 1 is not as cool in practice as it appears on paper.

Then we are told that the copper in the crucible (?) Fig. 2 can be poured by removing the cap. We have got Mr. Farnsworth's word for this, but as the copper is not going to climb up, and as the exterior is covered with sand, charcoal, brick and wood, all without handles, we are obliged to ask for further instructions, before undertaking to empty this crucible.

In Fig. 3 Mr. Farnsworth claims that the gate set at an angle is going to give the metal a whirl. We will bet his head will be whirling before the metal. If we could not obtain a brass bearing in any other way we might even go so far as to use a core barrel with a collar shrunk on and a solid stub welded in with taper, thread and all. Mr. Farnsworth says he has got out some satisfactory brass bearings in this way, and he is entitled to the champion liarship of the year.

We have published this example of "metallurgy" in order to show our readers what is being palmed off on the unsuspecting foundrymen as "modern practice." It carries on the face of it evidence that the author should spend some time in a kindergarten before attempting to write of something of which he knows nothing. If we had found this in some newspaper we should have let it pass without a thought, but when "a standard authority on all matters relating to the iron and metal trades" such as the Iron Age, is misled into biting at this kind of a "skin game," and we presume even paid for the privilege of printing such absurd "rot," and the Mechanical World, of Manchester, England, another paper which lays claims to being a "practical" journal, in blissful ignorance reprints the same, we think it is about time to call a halt on some of these amateurs who are furnishing literature on foundry subjects in order to keep themselves supplied with free lunch.—Ed.)

The "Can" and "Will" of Workmen.

Workmen are of three kinds—the class who can and will, the class who will but can't, and the class who can but won't. As to the proportion of these classes to each other, it is not easy to calculate, but it is much too great in favor of the latter two. The first class is, of course, the most desirable; the second tolerable and worthy of encouragement, as a rule, and the third is not wanted at all. These are the men who labor harder in shirking work than they would by conscientious toil; the men who fear they will do more than they are paid for, not asking themselves how it will ever become known that they are worth more than they get if they don't show their ability. Their presence also has a baneful effect upon willing workers. A fourth possible class, who can't and won't, need not be considered, as the consciousness of his inability is likely to change the won't to will without persuasion.—Woodworker.

Good for Everybody.

We consider THE FOUNDRY the best trade journal we have ever read. It is good for the workman, proprietor, or anyone connected with the foundry business.

J. P. GOLDEN.

Columbus, Ga.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

THE FOUNDRY

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Trade Outlook.

In a recent review of trade R. G. Dun & Co. said: "July and August show a lower average of liabilities per failure than has ever been known in any year, or even in any quarter of the 23 years R. G. Dun & Co. have kept quarterly records. The improvement is also well distributed, extending to nearly every important branch of business."

We are quoting the above because it comes from a source which is not liable to have its opinion warped by political considerations. The slow, and at times, almost imperceptible improvement has at last gathered sufficient force to make itself felt.

Consumption of pig iron seems for the present to be ahead of production and some difficulties are being encountered by sellers in securing stock for shipment. A favorable indication is that the car load trade coming from smaller foundries which only buy iron as they need it is making itself felt in the market. It means that more iron is being melted and that ordinary foundries are having more work than has been the case for a long time.

That the iron market is hardening is shown by the inability of foundries to contract for future deliveries at present prices. Most of the furnaces are obtaining an advance of 50 cents on future orders and even at that price several of the large producers are out of the market, having contracted for the sale of their full output sometime ago, and are advising customers that they are fully sold up to January 1st next. The makers of agricultural implements have all had such a good season and seem to think the prospects so good that there is every likelihood of their running full handed all winter on next season's product.

In many of the jobbing shops business is poor, though getting better slowly. Foundries working on specialties such as mechanics' tools and wood working machinery report a considerable improvement.

The car shops are all getting busied and most of the malleable iron foundries are running full handed and the stove factories are naturally at this season working full time.

What Good Times Will Show.

There is going to be in this country very shortly a dearth of good molders for machinery work.

The hard times of the past four or five years have driven a good many molders out of the business into other occupations.

A great many foundries, especially in smaller towns and villages, have gone out of business and are only just now being reopened and are inquiring for competent mechanics. A very small number of apprentices have been employed, partly owing to the foregoing reasons, the uncertainty of the outlook, and the small wages that have recently been paid mechanics of the best sort.

Added to this there has been an entire cessation of immigration from England, Scotland and other European points that have hitherto helped fill our foundries, because of the much better condition existing in those countries.

These reasons, coupled with the growing disinclination of the American boy to learn a trade in the regular way, have all had their effect and the result will shortly be both seen and felt.

When the shoe commences to pinch, as it very quickly will if business picks up appreciably, then our foundryman will turn their attention to the need of adopting and establishing a uniform apprenticeship system that will enable them to train up a generation of American molders, accustomed to American methods and used to American conditions. They will have before them the necessity of earning their living by their skill and will put into their occupation a degree of energy and ambition not possible otherwise.

The hour is not far away either when large numbers of foundries will be seeking good men and wondering why they cannot be secured. When that time comes, let it be remembered that molders themselves are not to blame because they are not better mechanics or because there is not more of them. We will be confronting a condition of things the result of past methods or systems, the controlling of which has never been in the molders' hands.

One Way of Obtaining a High Ratio.

There is a certain shop in Moline, Ills., in which the molders have had some kind of a dispute with their foreman, in which the course of events has cast suspicion on the truthfulness of some of the high melting ratios which occasionally appear in different sections of the country. The molders charge the foreman among other things, with having melted iron at 1 to 8 instead of 1 to 11 as he reported to the company. It may be for the sake of revenge that this assertion is made, but we all know the desire which some foundries have for a high melting ratio, and we must confess it is beating the band how some of them do melt—on paper. We have a strong suspicion that if the truth was known, more than one shop has two melting ratios, one on its books, which looks nice, and another on the scaffold, which is closer to the truth, and is, after all, what counts, even if it is nothing to blow about.

One Report of Prosperity.

A Mr. Patterson reports to the Lansing (Mich.) Journal that the Excelsior Foundry, of Bay City, will commence operations September 1, with a furnace capacity of 30,000 tons. Mr. Patterson is too good a story teller to be a reporter for the Journal and we would suggest that he apply for a job with some political information bureau.

Little Things.

In noting the success which has attended the modernizing of some manufacturing establishments the close observer will be struck with the almost infinitesimal smallness of some of the savings effected. Many of these improvements would be passed by the average individual as not worth their cost. Yet the comparatively great reduction in cost of production which has taken place within a few years in all lines of manufacture has been accomplished mostly by looking after little things.

The greatest saving effected in foundries seldom finds its way into print, because in most cases it is considered too small to talk about. However much we may dilate upon new methods of doing a large job it remains after all for the saving effected in little things to swell the total, so that it represents a respectable figure.

The Management of Men.

In nearly all workshops there will appear differences between the employer and employes, of such a general character as to

permit their presentation by a single individual. Where the employes are organized a shop committee is generally delegated to adjust these matters and it is to the treatment of the men who serve in this capacity that we want to call attention.

When a grievance occurs in a shop it is but natural to suppose that the men will choose one of their best co-workers, one in whom the employer has placed confidence, to represent their case. It has been recorded too often how men have been discharged, or laid off permanently, for having thus served on a shop committee, and we want to show that this has not resulted in any benefit to the employer.

As a matter of fact it has got so in many shops that any man who desires to keep his job will not serve on a shop committee for fear of being displaced. In place of choosing a workman in whom the employer has confidence, we find the employes singling out a man who is noted for his independence, who does not care whether he holds his job or not. Sometimes this fellow's independence is only another name for arrogance and insolence, but the employer can blame himself for the change. Instead of permitting his men to send a reasonable member, he has by his action compelled them to delegate their representation to an outsider who can not be expected to consider many things which are unknown to him.

If employers would show less inclination to take revenge on those who serve on shop committees, they would soon find their most intelligent and trusted employes serving in this capacity and it need not be said that they would find it so much easier to adjust matters with these men than with those merely having a passing interest in the subject.

A case recently came under our notice where an employer, who found himself short of work, gave orders that no man should be laid off who had served on a shop committee. He gave as his reason for this action that he did not want it to appear as if he had spite against those who had the courage to tell him of their grievances. This may not be anything to holler about, but it is looking at the subject with a great deal more common sense than we usually find.

This Country is Good Enough.

The Hartford (Conn.) Courant is authority for the statement that the Pratt & Cady Co., of that city, recently received a letter from an English brass foundry, saying that owing to the great number of brass molders involved in the eight-hour movement in that country there was an opportunity for American workmen to secure positions. "The wages earned would be 40 shillings a week," said the letter, "but if American molders work as rapidly as is reported they can make 60 shillings." Of course, there is an implied compliment to the general rapidity of the American molder, but the "Courant" adds "that no one has been found willing to make the change. America seems to be good enough for the average American mechanic, although there is no anti-contract law in England to prevent the importation of foreign labor." In spite of all the hard times which have visited the American workman of late years, he shows but little inclination to emigrate to the land from which he came.—It is true we can find him on the street corner, saying that he could make more money outside of the United States than in it, but when asked how it comes that he is staying here he gives no answer.—This country is not as good by any means, as we would like to see it, but the fact remains, that people, who are thoroughly acquainted with conditions on the other side, but seldom return for the purpose of entering the ranks of workingmen. —The good points of other countries held up for our inspection at a distance are not as solid and lasting when observed at a close range.—The workingmen of this country will think twice before leaving it.

Krank's Korner.

One of the things, which causes me severe pain, is to find an employer yelling about running his shop for the benefit of his men. He may be doing it, but the chances are, if he is, that it is not his fault.

Too many of these people, who make such frantic efforts to pose as philanthropists, make a low bid, and then when they see their mistake, they try to make out that this was done intentionally.

No sane man is going to embark in any business enterprise unless he believes there is something in it. The relation between

capital and labor is one of business, and some of the sentiments to the contrary are entirely out of place.

A manufacturing concern may undertake a contract, knowing they will actually lose money thereby, but if they do so, it is not for the interest of their employes, but for themselves. They are simply choosing between two evils. If they leave their works stand idle, there is a certain loss from depreciation and if their workmen are specially trained, there will be a subsequent loss in training new operatives, if the former should leave the locality. The employer may make a sacrifice, but it will be seen that there are other influences, compelling him to do so, besides the interest he may have in his employes.

When a man says he is losing money by selling an article at a certain price, he is seldom believed, for he is surely not in business for his health. Neither is anyone else. Employer and employe, both alike, are connected by the link of business, and the less there is said about philanthropy, where business only can exist, the less ridiculously will either party appear.

An English View of Blow-Holes in Castings.

What we call blow-holes in castings are caused by the metal heaving out of the runner or riser. That is due mostly to the core being too hard or not thoroughly dry. How can this be overcome? In the first instance, you may have your sand too damp for the top part, or you may have too much coal-dust in it, causing a great amount of gas to flow to the top; at times this becomes imprisoned in the mold, and unless you have risers for it to flow through, then little holes will be formed. Much depends on the size of the casting. For small engine castings—which are the most troublesome—I should say, prick a few holes in the top part of the mold, not through the mold, and one especially near the runner, to let the imprisoned air out. Do not use coal-dust in the sand, but simply black sand.

Another drawback sometimes is that the metal is not well melted and the dirt is not out of it, and then you are bound to find holes in castings. Another difficulty arises in the class of metal used. You may find at times many small bubbles in a casting; this is simply through imprisoned air. Sometimes too much coal-dust in the sand causes gas holes in the castings. Run one casting with the mold dried, and one with it wet, and you will soon find that the gas and air are out of the dry one, which gives by far the best casting. If there is coal-dust in the sand it must cause gas; if no coal-dust, there is air or steam.—T. W. W., in Mechanical World.

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

WELDING CAST IRON TO STEEL.

Can molten cast iron be made to amalgamate with the surface of steel against which it is poured? This question may have been suggested by reading the paper which was presented by Mr. Newkirk at the last meeting of the Philadelphia Foundrymen's Association, entitled "Welding Rail Joints with Cast Iron." If the joints are welded the metals must become one at the point of contact. A couple of years ago I happened to go into a foundry where they were making rolls for mills to be used in grinding sugar cane. The rolls were molded end up. Just before pouring, the mold was opened and a warmed steel shaft was set in prepared recesses in the bottom and top of the mold and melted cast iron was poured around it. Sometimes the iron became apparently a part of the steel, while at other times the iron would shrink away and leave the shaft loose, in which case the iron had to be broken off, as the roll was of no use. The steel shaft was warmed to prevent its condensing the moisture of the mold, and its surface was freshly ground to cause an unoxidised surface to be presented to the inflowing metal.

The method employed in Philadelphia is to scrape the rails clean and bright, and to dry out all moisture before the cast iron is poured around them.

About the same time a founder from the far West had taken a contract to make some castings, in each of which was a small steel shaft. In the sample casting the iron and steel seemed to be welded, but in the castings which were made the steel was loose. Also about this time the superintendent of a mill

where a large amount of steel rails for street railroads was being made wrote for information on this same subject. The crossings for these tracks are made by placing the rail ends together, with necessary steel surface pieces, and then pour cast iron around them. There were often failures in making a mold. Each of these people had tried every flux that they could think of. In casting steel along with cast iron I had covered the steel with silicate of soda. The silicate was diluted with water until quite fluid, and heated. The steel, previously brightened to remove oxide, and warmed, was dipped into the fluid silicate.

I suggested in each of the above cases the use of fluid silicate, applied to polished surfaces with a brush. For the rolls and for the railroad crossings it proved a perfect success. For the heavy railroad crossings, after applying the silicate and before it was dry, powdered ferro manganese was dusted on and adhered to the silicate. The silicate forms a coat of glass over the surface of the steel, which melts when the molten iron strikes it and flows ahead of the iron. This keeps all air and moisture from the joint, and if no oxygen can reach the surface there can be no rust. If the surfaces are bright and the iron hot, there will be an absolute union. Inch square steel bars having four inches of their ends bedded in the cast iron could be pulled out when no fluxes, or when other fluxes were used, but with the silicate and powdered ferro manganese the steel bars would break off and not pull out.

It was at first thought that peculiar cast iron was needed to prevent the steel from becoming loose, but the success in the use of silicate showed that if oxide did not form on the steel surface there would be a weld.

MELTING DIFFERENT GRADES OF IRON AT ONE HEAT.

Please give us your opinion as to the advisability of melting several grades of iron in the same heat. For instance, in a 28-inch cupola, with tuyeres 15 inches above bottom, melting about one and one-half tons per hour, melt about one ton No. 3 pig iron for plow mold-boards, one-half ton for plow-points of No. 3 pig iron and good machinery scrap, then one ton of cheap scrap, such as stove plate, grate bars, old pots and burnt casting, for making a line of grate bars or other casting when it is not specially necessary to turn out first-class goods. Can these different grades or lots of iron be successfully melted and run into the various castings without getting the different grades mixed?

By placing a larger charge of fuel above each grade of iron than is necessary for melting, there will be no mixing of the different grades. Iron cannot melt until it reaches the melting point. The excess of fuel must burn away before the next iron can reach the melting zone of the cupola. By estimating the amount of iron drawn out, the founder can tell when any kind is melted, and when the iron stops coming he knows that it is all down and will stop the tap-hole until the extra fuel burns away and the next iron accumulates.

The hard iron should be charged first, because the cupola is not as hot as later, and because it is safer to get the harder grades out of the way. For small cupolas, coke is more likely to hang up. With anthracite coal iron can be melted in a cupola 16 inches diameter, or even smaller. With coal, the charges are more certain to descend as they are put in, but with a 24 or 28-inch cupola coke is all right.

The above description of the mixture of grate bars and all of the castings exclusive of mold-boards and plowpoints, suggests the question, What is the best mixture for grate bars? If a founder who makes a specialty of grate bars would experiment with mixtures and keep a record of the life of the bars while in use, the information would be valuable.

Test Bars.

By Dr. R. MOLDENKE.

At the first glance this subject would appear to the reader as one which had been pretty well threshed out by this time, but it only goes to show that in these days of advancement and searching analysis of the physical as well as chemical constitution of the metals, much that has been written may be at least modified if not completely changed. The writer feels indebted to Mr. Keep for stirring up the mud again in connection with his one-half inch test bar, and in turn enabling Mr. West to reply with an able article on this subject in the September number of THE FOUNDRY. Careful study of this question, so far as cast iron is con-

cerned, from what is written in the text books, and given in the reports of the commissions of the great engineering bodies the world over, fails to disclose any evidence that the practical founder has been asked for his opinion of the matter.

The ideas of mere theorists will not answer, and while science must be the ever present guide to direct the investigations, keep them within the proper lines of research, and help to formulate the conclusions, yet the actual work must be done by the founder, and his experience drawn upon in giving proper weight to the various pros and cons arising in the methods to be selected.

Once the mode of preparing the test bars, and the shape they should be in to best represent the actual conditions in the delivered work, has been determined upon in this manner, the structural engineer may come in and decide how the bars should be tested to give him the best idea of the nature of the material he has to deal with.

This brings up the question of the purpose of test bars, and it would look as if the subject branches out here into several subdivisions. Primarily the test bar is to show its maker what information can be obtained in regard to the physical quality of the material he has cast. In other words his product is already complete, but he has to some extent a safeguard which will enable him to ship his work with an easy conscience, or scrap it if not up to requirements. Secondly, the test bar serves as a fund of information, the careful study of which is of great value to the founder in subsequent work. In both cases just mentioned the test bar should approach the leading dimensions of the work, or better still, be cut directly out of a casting rejected for some surface blemish. Even if test bars are made regularly, it will pay to compare the results obtained from them with those of bars cut out of castings, for experience with hundreds of bars so prepared contrasted with thousands of the regular make has shown the writer that the results are always in favor of the separately cast bar.

The third phase of the question is the preparation of test bars which will indicate the value of the material irrespective of the particular work in hand, and should serve only as a means of comparison with the work of others. This variety of test bars is the one which is of special interest to the iron trade, the others being strictly for the individual shop.

To the founder buying iron, to the blast furnace man selling it, to the consumer paying for the castings, it is of great importance to know the physical strength of the material he is dealing with, and the establishment of a uniform system of making test bars is of the utmost importance in making universal comparisons, for we are well aware of the fact that with all the help chemistry gives us, a casting may have the right amount of silicon, etc., and yet be rotten. The present agitation is, therefore, well timed and should be encouraged sufficiently until the matter may be taken up by bodies of authority, not individual workers only, and brought to a state of perfection warranted by the state of knowledge available at the time.

What body of men is better situated to solve this question than the National Foundrymen's Association of America. In view of the earnest work on the other side of the water, as carried on by the International Society for Standardizing the Methods of Testing Materials of Construction, nothing would be more welcome than the co-operation of the American foundrymen, for the foundry is just as backward there as here, and now that the beginning is made to improve the status of the trade, it should surely also embrace the material which forms its foundation.

The writer would therefore call attention to the advisability of the National Association to take up this matter with a view of an international agreement ultimately. For the time being, however, the appointment of a commission of impartial men would seem best, to be drawn from the practical as well as scientific members of the Association, instructing them to draw up a line of questions on which to call for the opinions of the members of the foundry trade, the replies to be discussed and specifications formulated therefrom.

A call for test bars could now be made on these specifications which should embrace every branch of the foundry trade, and doubtless a large number of firms could be interested sufficiently to make the showing very complete. These bars, carefully an-

alyzed and tested, would form the basis of a report which would represent the foundryman's view on the subject of test bars, and serve as a basis of comparison for all engaged in the foundry trade wishing to inform themselves of the relative value of the material they are handling.

As the International Society is well represented in the National Association of Foundrymen, it would later on be an easy matter to make connections in such a way that eventually a universal set of specifications may cover the whole subject of the varieties of cast iron the world over. Some one must begin—will it be the National?

C. J. Wolff.

The new vice-president of the American Foundrymen's Association for the Northwestern States, Mr. C. J. Wolff, was born in Chicago, August 18, 1861. He is a son of

Ludwig Wolff, the founder and president of the L. Wolff Mfg. Co., and one of Chicago's pioneers.

Mr. C. J. Wolff received his early education in the public schools and later graduated from Racine College, after which he took a course of mechanical studies in the Royal Polytechnic Institute of Hanover, Germany.

The pet study of Mr. Wolff is chemistry, which has proven of considerable value to him in the management of the iron and brass foundries connected with the firm. He is a member of the Western Foundrymen's Association, and will undoubtedly prove himself a creditable officer of the National Association.

Joseph Best.

Mr. Joseph Best, who has filled the office of vice-president for Canada since the formation of the American Foundrymen's Association, was born in Cornwall, England, in 1847. At a very early age he began actual work and when fourteen years old was admitted to the works of William West & Sons, engineers and founders, where he spent ten years acquiring a knowledge of the foundry, machine and pattern shop.

In 1871 he arrived in Montreal, Canada, and began his labors in the new world as foreman for Robert Mitchel & Co. After two years' service with this firm, Mr. Best established a shop of his own, which he conducted for thirteen years, when he disposed of his interest therein in order to accept the position of superintendent for Warden King & Son, which he occupies at the present time.

Mr. Best has always taken an active interest in the many questions which have come before the American Foundrymen's Association, and being a man who has risen from the bottom, employer and employe alike, find much of interest in his conservative arguments.

Philadelphia Foundrymen's Association.

The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on the evening of Wednesday, September 1, with President P. D. Wanner in the chair. Mr. Wanner made a characteristic address reviewing the state of trade from a political standpoint since the last meeting of the Association, and prophesying better things for the future now that the tariff question has been settled. Secretary Evans then read the following report of the executive committee:

"This is the first meeting since our summer recess. It is hoped that our members have had an opportunity to leave their shops for a short time to visit the mountains and the sea shore, that they may be prepared to struggle with the anticipated business that is promised us by the newspapers. As a matter of fact, it is a question in our mind as to whether the newspapers have been entirely correct. We acknowledge there is a better feeling existing in the different lines of trade, but it is a question if the foundry trade has been benefited up to this date. If it has been benefited, we would like to know to what extent. Is there a greater demand for castings and has there been any advance in prices? We know of a few foundries that are really very busy, and have sufficient work to run them for several months ahead. But while this is the case, we know of a great many other foundries, composing the greater majority, which have very little, or nothing to do. Therefore it is our purpose to-night to ask those who are present how they have been affected. At our last meeting in June, there seemed to be a better feeling existing than there was in January and February. We now want to know what the summer months have brought forth, and if the improvement is still advancing. The rapid advance in wheat of course has been a great boon to the farmer. This will mean a profit to those who did not sell before the advance, and will encourage them up to the point of buying new machinery to assist in gathering the next crop. It will mean the building of new cars, and locomotives to the railroads, and a great many other interests which in the end will redound to the benefit of the foundry. It seems to us that we see in the distance the silver lining of prosperity in the dark cloud that has covered us for the last two or three years."

Following the reading of this report, a number of gentlemen present were requested to tell their experiences in summer trade. Stanley G. Flagg, representing small gray iron castings; P. D. Wanner and C. L. Prince, representing cast iron pipe; and W. T. Bate, general castings, announced that prospects at present were encouraging. Thomas Glover and J. S. Sterling, however, could offer nothing particularly encouraging. Thomas Devlin said that trade had been a bit better during August, but that the first seven months of this year were considerably behind the corresponding period of 1896. Antonio Pessano, vice-president of the George V. Cresson Co., reported a great improvement. Their shops, he said, were full of work, with a prospect of much more to come. Mr. Pessano raised a question for discussion. He wanted to know if anybody present had experimented upon the cost of cupola linings in relation to the melt. By notes taken over a long period, he had found that the production of 620 tons meant the outlay on an average of $26 for firebrick lining. No one else had any testimony to offer upon the question.

Secretary Evans announced that the check for $50 which the Association had contributed to defray the expenses of the recent convention had been returned with thanks. He was pleased to report that the contributors to the convention fund were being paid a fair dividend of the surplus.

Mr. I. Roberts Newkirk, of Wm. Wharton, Jr., & Co., Inc., then read the following paper upon

WELDING JOINTS WITH CAST IRON.

Cast welding rail joints is not a new idea, either in theory or practice, although it no doubt is to many here and in this city.

Probably many of you have already seen the practical operation we are now carrying on at various parts of the city. The principal claims for this style of joint are: First, A very stiff, rigid joint. Second, the most practical way of increasing the life of partly worn-out rails. Third, A saving in the cost of keeping up a good road bed. Fourth, Electric bonding of rails without any separate copper bonds. The apparatus required for carrying on this work successfully con-

sists of, first, a good cupola with spout and slag-hole mounted with gimbal joints on a very strongly built wagon that also carries within a closed box an electric motor. This drives a fan, supplying the required blast to the cupola through a pipe, with a flexible connection, this being made necessary by the swinging of the cupola to a perpendicular position, that has to be provided for on account of the unevenness of the street grades.

The charging of the cupola is exactly the same as in ordinary foundry practice, there being no special physical or chemical requirements for the metal, beyond the fact that we have to use a strong mixture of iron and hot enough so that it will thoroughly amalgamate with the steel rails. We use coke entirely as fuel.

Power is supplied from the overhead trolley wire by an insulated wire attached at one end to the motor through the rheostat, at the other to a special flat copper shoe, fastened to a pole which a man standing on the ground raises and hangs on the overhead trolley wire. The return is made through ground connection by wire fastened direct to the rails. A switch and automatic rheostat are used to stop or start the motor at the will of the operator. The shape or form of the mold is made by cast iron chills made in halves, which are set in their correct positions and held by a clamp.

Early in the evening a gang of men start to clean and scrape the rails prior to putting on the iron chills, to do this successfully we find it necessary to use specially built heaters to dry the damp dirt, etc., that sticks closely to the rails and is very hard to remove. After this the rails are scraped and cleaned as bright as possible, this being necessary to make the iron amalgamate thoroughly with the rails.

The rails are then surfaced and also lined up; then a screw clamp is put on, connected at each end by a clamp hooking under each rail. Then a head piece is placed on the rails covering each end and the screw of the clamp is screwed down tight, holding the rails in a properly adjusted position, while the iron is poured in on one side, amalgamating with the steel rails. After a mold is poured and a sufficient time has elapsed for the iron to set, the clamp and chills are removed and the same operation gone through again at another joint. We use an electric grinding machine for grinding the top of the head of the rails to an even surface.

The question of expansion and contraction has been a grave matter to deal with; this has been practically settled in the following way: The joints are generally made in warm weather when the rails are expanded to their extreme limit. At each end of a square, or say about every 400 feet an expansion joint is made, that is, a joint which is not amalgamated with one end of the rails. Some railroad men prefer to have all the joints solid, so when the rails contract in cold weather, some joint, having been weakened by blow holes due to any rusty scale or any other cause, will break. The rails will then spread perhaps as much as two or three inches. The joint should then be broken off and a small piece of new rail set in and then a new joint made or cast on. This has been the experience in Chicago and elsewhere where the rails are subjected to extreme heat and cold alternately.

The expansion of the rail above the ground where it is free often has a tendency to buckle the rail sideways. In street rails it is different, owing to the strong paving holding it in place. Therefore there is quite a compression at the ends of the rails, keeping them from expanding to their full limit. Again, owing to a certain amount of friction due to the paving, etc., the rails cannot contract near as much as they would if left above ground. The first winter is generally the hardest test for this style of street railroad construction; but after the above repairs are made generally very little trouble is found.

The amalgamation of the iron and rails together usually gives a greater area of surface to carry the current through than is given by the section of rail itself. In practical experience it is known that the large area of cast iron makes the joint much stronger than the rail and when the tremendous contracting strain has been exerted, the rails have broken and pulled apart at some point between the joints.

The Pennsylvania Railroad is now experimenting with 100-ft. rails and the Lehigh Valley Railroad with 60-ft. rails; and very many street railways use 60-ft. rails, showing a growing tendency to have fewer joints to wear out and reduce the life of the rails.

The constant pounding of the wheels on the joints gradually wears an ordinary fish bar or joint plate down under the head of the rails. This in turn will wear away the under part of the head of the rail and then follows the loose joint. To repair this properly we would have to fit a pair of joint plates to each special joint, which would be a very expensive operation.

We usually place the cupola, drawn by five horses, about one square away from the farthest joint to be poured and carry the iron that comes very hot from the cupola back to the joint. We pour each one in turn up to the cupola and then as much past it as is found feasible. We then stop the motor and take off our feed wire and move the cupola to another position and start to melt as quickly as possible, always trying to avoid chilling the cupola any more than we can help. We have melted about 6,000 pounds per hour with our present cupola, of the Whiting Foundry Equipment Co.'s make.

Owing to the small ladles in which the iron is tapped and the rapidity of melting, it keeps two men busy all the time tapping out and a gang constantly charging.

While the cast welded joint certainly seems superior to the fish bar joint, I do not think any actual comparison tests between the two have been recorded, therefore I am not prepared to state the increased length of life of the average run of rails at this time. The present electric traction cars are much heavier than the old style horse cars and wear out the rails much more rapidly and have a greater deteriorating effect on the road bed.

In the discussion which followed the reading of the paper, the question of the amalgamation of the two metals was raised, and Mr. Newkirk said that there was no doubt in his mind that they united. That being the case the copper connectors or bonds for carrying the current from rail to rail were not required.

The contraction and expansion of the rails by changes of temperature was another interesting question, and Mr. Newkirk in response to inquiries stated that in Chicago where the extremes of temperature were greater than here, the contraction would occasionally pull the rails apart at the joint, and in one instance the rail itself had been pulled apart. The first winter generally develops these weak places, and they are repaired by inserting a piece of rail to fill up the gap, and welding it in place. The welding, however, is not continued across the junction of streets, nor at curves and switches. At crossings an expansion joint, or slip joint, is placed which permits considerable movement of the rail longitudinally.

Chief Trautwine, of the City Bureau of Water, asked whether such a joint made a good electrical connection for the passage of the large currents flowing in the tracks, as, if it did not, much of the current would escape to the water pipes, to their detriment.

Mr. Newkirk replied that no copper bonds had been supplied to span these joints, and he did not believe there was any necessity for them. He did not know that any electrical tests had been made to show this.

No estimate of the cost of the process in comparison with the fish plate method of joining rails could be given, but Mr. Newkirk said that the greatest number of welds made in one night with a gang of 60 men was 102, which would give an idea of the labor and cost.

"Cast Steel" and "Steel Casting."

"Cast steel" is a term that was introduced to distinguish crucible steel from "blister steel" or "weld steel" at the time crucible steel came into use, and once indicated the highest quality. To-day the term means nothing definite, for Bessemer and open-hearth steels, both basic and acid, now are all "cast steels." The term "cast steel" might by this time have passed into history, were it not due to the practice of many manufacturers of hardware untruthfully stamping the words on inferior articles, and allowing the unsuspecting public to infer that it is the same metal that their great grandfathers thought so highly of.

While the "cast steel" of to-day is very likely to be a brittle and worthless material, a good steel casting is quite the opposite. Good steel castings are not only strong but tough, and have ductility and malleability not much inferior to rolled structural steel. A round rod turned from a steel casting may be tied in a knot, cold, and after cutting the felloe of a wheel between the spokes, the latter may be twisted up or bent over on the hub without a break. Moreover, steel cast-

ings may be forged hot or straightened cold.

It is safe to say that any machine or structural casting that can be made in iron can also be as well or better made in a steel casting, and with the result that instead of having a weak and brittle object, we have one that is tough, ductile and of many degrees of strength that may have been decided on beforehand. Steel castings may be safely and economically used in tension as well as compression, which iron castings cannot.

Having discovered the general value, utility and economy of steel castings for important work, it will not do to simply order or specify a "steel casting," or we may find that we had better have stuck to iron castings. There have been many so called steel castings that it would bother any metallurgist to classify with any known or recognized product, beyond the fact that they contained nearly 100 per cent of iron; they have lacked many elements that they should have had, and contained to excess many that they should have lacked. To obtain a good steel casting we must have a good specification, and for ordinary and general purposes the following will give good results:

Steel castings shall be made of acid open-hearth steel containing not more thon .08 of 1 per cent of phosphorus nor more than .05 of 1 per cent of sulphur.

They shall be carefully and uniformly annealed, and test pieces cut from annealed castings shall have a maximum tensile strength of not less than 60,000 pounds per square inch and an elongation after fracture of not less than 20 per cent on an original length of two inches. Castings shall be true to drawings, smooth, clean and free from blowholes, sponginess, and other defects.

For important or special work a more elaborate specification should be made, in which the strength may be increased to 90,000 pounds if desirable, the phosphorus and sulphur lowered, and account taken of manganese and silicon, which are important but not dangerous elements in steel castings.

It is the general American, but not European, practice to specify elastic limits for structural materials. If this is done for steel castings the minimum should be placed at 45 per cent of the maximum strength, as owing to lack of work by rolling or forging it will often fall to this point.

Acid open-hearth steel has been specified as it is according to the best practice of the largest steel founders, and for very good reasons. It requires the best of melting stock, and its composition can be accurately calculated beforehand. When the steel is made it can be held in the furnace for a reasonable length of time without change or deterioration, while molds are being placed or changed, which is not the case with basic steel.

Welds on steel castings, or, in fact, in any form of Bessemer or open-hearth steel, should be carefully avoided as they are very unreliable and uncertain.

The original "blister steel" welded readily, as it retained the cinder of the wrought iron from which it was made, but Bessemer and open-hearth steel contain no cinder to form a natural flux, and heated surfaces oxidize at once on exposure to the air.—A. C. Cunningham, in Railroad Gazette.

Another Revolution Coming.

This time Springfield, Ohio, is the storm-center, as is shown by the following:

"A successful test was made at the foundry in the big East street shops of a process of making various grades of anti-friction steel direct from molten pig iron. The first successful test was made yesterday afternoon in Gov. Bushnell's foundry. Both tests were attended by the leading capitalists and manufacturers of the city.

"The discoverer of the process is John B. Hastings, of Bellaire, Ohio, an old iron-worker of 40 years' experience. Associated with him are J. Bold and Charles Koplin, both of Bellaire. Their object in coming here is to interest local capitalists with a view to establishing a plant in the big East street shops, built by Reaper King Whitely, and now almost wholly vacant. Mr. Bold said to-night that they could, within three years, occupy every foot of space in East street shops, which would be equivalent to having 3,000 men at work. James Cashman, assistant secretary of the Board of Trade, said to-night, in describing the tests:

"'It was wonderful to see those men pour some secret powder into molten pig iron and have that same iron come out of molds as the best steel tools at less than one-tenth the cost of the old process of forging.'"

"An effort will be made to get Senator Fairbanks, of Indianapolis, owner of the plant, interested in the process."—Springfield Republican.

It will be still more wonderful after Mr. Fairbanks and others put in a few thousand dollars. Here is what "Tin and Terne" says on the same subject:

"For some time past a gentleman of Bellaire, Ohio, has been making "tests" at various steel works and foundries of a process for the production of tool steel from the commonest grades of pig iron, or from scrap iron, and for greatly improving the quality of steel as it comes from the Bessemer converter, especially for tin plate work. The process consists in adding to the pig iron, scrap, or Bessemer steel, when in a molten condition, a secret substance which at once effects the most wonderful change in the character of the metal, and at a very small cost. The results of these tests have been dilated upon by daily newspaper writers. There is good ground for believing that the secret and mysterious process consists simply in the addition of a small quantity of manganese. The effects of manganese in such cases are well known to all who know anything about the properties of steel and iron, and manganese is now used in all cases where its addition is desirable. One of the "samples" tested broke at a tensile strain of 14,800 pounds per square inch, and another sample was shattered into numerous pieces when an attempt was made to forge it hot."

Tubal's Meditations.

1. A few ounces of the sweetness and geniality bestowed upon patrons, distributed among the employees, would often repay itself in tons.

2. If you put scrap iron in the cupola, you will get scrap iron out.

3. The molder that don't learn to "cuss" the patternmakers will never be successful at his trade.

4. A good flask costs no more than a cushioned office chair, yet the latter is often afforded and filled to the detriment of the former.

5. Although a molder may have wide experience with "bars" he is not necessarily a drunkard.

6. The only way to make good iron, is to put it in at the top.

7. You cannot expect to put rotten potatoes in the oven to bake and get out good ones.

8. The molder who kicks the most about small pay, does the least to deserve more.

9. The man who never reads his trade paper is generally one of those who say, "There's nothing in it."

10. Don't condemn a molder for making a bad casting until you see him repeat it in the same manner.

11. The man who is liberal with his advice generally carries a poor stock of that commodity.

12. A molder's sense of feeling should be highly cultivated. His hands are instruments to register the humidity in his sand, his feet are machines to assist in its proper compression, his fingers connections to telegraph his brain the condition of his mold, its hardness, softness, regularity or smoothness.

Never Too Late to Learn.

Remember, son, the world is older than you are by several years; that for thousands of years it has been so full of smarter, better and younger men than yourself that their feet stick out of the dormer windows; but when they died, the old globe went jogging along, and not one person in ten million went to their funeral, or even heard of their death. Be as smart as you can, of course. Know as much as you can without blowing the packing out of your cylinder heads. Shed the light of your wisdom abroad, but don't dazzle people with it. And don't imagine a thing is so simply because you say it is so. Don't be sorry for your father because he knows so much less than you do. The world has great need of young men, but no greater need than the young men have of it. Your clothes fit you better than your father's fit him—they cost more money, they are more stylish; your mustache is neater, the cut of your hair is better, and you are prettier than "pa." But stop a moment, young man, and reflect. The old gentleman gets the bigger salary, and his homely, scrawling signature on the business end of a check will drain more money out of the bank in five

minutes than perhaps your handsome autograph can do during the balance of your mortal life. Young men are useful and they are also ornamental, and we all like them—but they are no novelties, son, oh, no, nothing of the kind. They have been here before. Don't be so modest as to shut yourself clear out, but don't be so fresh that you will have to be put away in a cooler to keep from spoiling. Don't be afraid that your merit will not be discovered. People all over the world are looking for you, and if you are worth finding they will find you.—Exchange.

Chilled Iron and Chilling Iron.*

By E. H. PUTNAM.

At the request of the executive board of this society I have prepared this paper, and if, happily, it shall prove helpful, I shall consider that fact ample return for my endeavor. What I have to offer you is the fruit of long practice in iron founding. I cannot, of course, expect to give anything like an exhaustive exposition of the subject in the time at my disposal, but if I shall be so fortunate as to engage your attention I hope that our half hour will not have been unprofitably spent.

Chilled iron is iron that has been cast in a mold constructed, partly at least, of iron, one effect of which is to solidify the casting to a greater or less depth, so quickly as to prevent separation of the carbon from the iron. The elements in such iron are chemically combined with it (though in non-chilling iron it is impossible to hold the carbon in combination), producing an approximately uniform and close grain or texture and of white fracture, whereas, iron of the same grade or mixture cast without chilling presents a gray fracture and is comparatively coarse and rough in texture; because the carbon during the slow process of cooling has become separated from the iron and lies in flakes within the mass between the iron crystals.

Chilled iron or iron with its impurities held in combination by the mechanical means of chilling, is of much less transverse strength than the cellular gray iron, but its crushing resistance is vastly greater. Again, chilled iron, or iron whose carbon has been fastened in the combined state by chilling is much stronger than iron whose carbon is combined in the pig.

The grain of the fracture in chilled iron is very different from that in all other irons. Common white iron has a very irregular grain and much the same may be said of gray iron. But chilled iron of the highest class presents a beautiful fracture whose close lying crystals of uniform shape and dimensions, fine, and, to the practiced eye, satisfactory, are the happy response to intelligent effort and evince man's power over the things of nature.

CRYSTALLINE TEXTURE.

I said the cellular gray iron is coarse and rough. This is because of the uneven texture of the mass, the iron portion being a sort of honeycomb framework, whose cells are filled with graphitic carbon. The iron is hard and rigid, but the graphite is soft and flows almost like water under pressure of the fingers. Therefore, the chilled iron is immeasureably the better for the purpose of crushing anything; as grain, in the manufacture of flour, or of reducing rocks for various mechanical uses, such as making rubble for roadways, or of stamping ores. The gray iron being cellular and soft, would speedily wear out, becoming rough and therefore useless in a very short time. While the chilled roll, having a uniform texture of extreme hardness, would wear very slowly, and, more important still, very evenly throughout the whole area of surface.

Another feature of the chilled roll which renders it available where mere white, hard iron is out of the question, is the fact that it is hard and non-cellular only where such qualities are desirable, while the remainder of its mass is a very fine cellular structure, conducive to the greatest possible transverse strength, yet easily susceptible of tooling, thus rendering it, we might say, perfect for the uses to which it is put.

CHILLED PLOWS.

One of the largest uses to which chilled iron lends itself most admirably is in the manufacture of chilled plows. I remember an episode of chilling which happened in my father's foundry when I was but three years old. As I stood near my father, who was at that time manufacturing chilled plows, I saw a little child fall into the water tank. I

* Paper read before the Convention of the American Foundrymen's Association, Detroit, May, 1887.

mention this impressive circumstance in order that you may see why I recall a chilled plow foundry scene of forty-five years ago. Chilled plow foundrymen of that day realized but very little indeed of the splendid achievements that were yet to transpire in that line of industry. Any kind of iron would answer; the principal question being, is it cast on a chill? Indeed, it was almost a matter of indifference with most plow makers as to whether the chill were used or not. Still, there was nothing strange in this. The great things of this world are not each the fruit of the labor of an individual, but they are the crystalized product of the protracted efforts of many. And so, the chilled plow has attained its present state of approximate perfection only within the last twenty years. It is no part of my purpose to review the history of the evolution of the chilled plow at this time, but I mention it incidentally to the topic of chilled iron.

I have no practical knowledge of the chemistry of chilled iron, and therefore, as to this, I must trust to the dictum of those who have prosecuted their inquiries in this direction.

I find that chemists generally insist upon the imperative need of their peculiar skill in conjunction with that of the founder, and I am not at all sure but that chemical analysis could be employed in most foundries to advantage, from a money-making standpoint. But I am content to leave the advocacy of this system to such as can handle it better than I. Pardon me, however, if I state that I think the more appropriate place for the chemist is at the smelting furnace, where the iron is produced, and that all iron should be analyzed and the character guaranteed. The smelting furnace generally falls very far short of what it must yet attain to in the matter of accommodating its customers.

Chilled iron has certain physical characteristics that indicate excellence in quality, and these are the only guide of most foundrymen in the conduct of their business. It would be impossible to describe these in such a way as to convey an intelligible idea to the novice in chilled iron; yet they may, I think, be so described that he who follows the business and watches it closely, comparing results with this description, will know when he is producing good or bad iron. For it is quite possible to produce very bad results with the very best of iron.

The desideratum is a fine grained, solid, strong and very hard iron. Some irons or mixtures of irons produce a very coarse crystal, and are therefore intolerable, because weak, if nothing else. When this occurs, simply change the proportions of the various irons in the mixture as indicated till the fine crystal and the normal strength appear.

Chilled iron sometimes, like gray iron, has small cavities which are, of course, in the last degree objectionable. You frequently see these cavities in the pig. Remelt this pig with a per cent of scrap and pour it into castings and the tendency to show cavities will be diminished. But take this pig iron and say, two other brands of pig, and mix them with a proper per cent (say 50 per cent) of scrap and the cavities will probably

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E. H. Putnam was born in Warsaw, N. Y., March 8, 1849. His father removed shortly afterwards to northern Illinois and engaged in the foundry business, where young Putnam acquired his first rudiments of the trade.

During the last 14 years Mr. Putnam has occupied the position of foreman. For eight years he was thus connected with the Chattanooga (Tenn.) Plow Works, and resigned his position a few weeks ago to become superintendent of the Southern Agricultural Works at Atlanta, Ga.

Mr. Putnam's recreation consists of writing on foundry topics, wherein he has achieved considerable success as editor of the Foundry Department of "The Tradesman."

At the recent convention of the American Foundrymen's Association Mr. Putnam was elected vice-president for the Southern States, and his activity in behalf of the foundrymen's interests is given a new field, which will undoubtedly redound to his credit.

disappear. It is the same old fact that iron is improved by remelting, to a limited extent.

It is desirable to chill some castings clear through, so that a fracture through any section will be entirely white, while in other castings the depth of chill should be but a fraction of the whole diameter. But we shall do well always to bear in mind that white iron or iron in which the carbon is all combined is, as to transverse resistance, weak, though the same iron poured into a sand mold and not chilled might be of the very strongest. It is, then, obvious that the tendency to chill should be no greater than the work in hand demands, in order to secure the highest possible strength.

Hardness is inherent in true chilling iron well chilled, and the normal strength results from following the above rules, provided you gauge properly the chilling tendency of the mixture.

Let me make sure of being understood about this. If the only desideratum were that the tendency to chill should be sufficient, then the making of a chill mixture would be one of the simplest of matters. But, in fact, any considerable excess of chill tendency detracts from the quality of the casting, because, while it gives nothing desirable, it diminishes the strength. This refers, of course, to deep chilling mixtures. The permissible latitude is, however, sufficient for all practical purposes. That is, a skillful ordering of the mixture will insure sufficient chill without sacrifice of strength. And, on the choice of irons for this mixture, largely depends the amount of profit, for there are several dollars difference per ton between two first-class chilling mixtures.

THE DIFFICULTIES IN MAKING CLEAN CHILLED WORK.

Many people find it difficult to make clean chilled work. This arises partly from the fact that iron, so hot as this should be melted and cast, will cut and disturb the sand more than the less heated soft iron. For, though white iron may fuse at a lower temperature than gray iron, it certainly requires a much higher temperature to make it sufficiently fluid for casting.

Pardon me if I dwell for a moment upon this point. I cannot but think that a great many foundrymen have had very disheartening experience in the manipulation of white iron and chilled iron, just because they have heard or read somewhere or perhaps everywhere that iron high in combined carbon melts at a lower temperature than soft gray iron. In the light of my own experience, I wish that every man who asserts that hard iron fuses at a lower temperature than gray iron would at the same time explain that because of being less fluid, it must have much higher heat in order to successful casting. But does chilling iron really fuse at a lower degree than soft gray iron? I see that some recent writers deny it; and I am glad of it! I hope, in the name of consistency, that the denial will be sustained; for it is a seeming paradox to say that hard iron fuses at a lower degree than gray iron, while you know that in order to cast successfully your hard iron you must use much more coke than with gray iron. But this is a question for the chemists to settle and I am content to leave it with them. Though I must give them this parting shot, that is, however much less heat it may take to melt hard iron, it certainly requires a great deal more heat before it can be cast.

Extraordinary precautions should be taken against dirt in chilled iron. As foundrymen generally know, the surface iron in the process of filling a mold does not flow, but chills and clings to the mold surfaces or walls, while the iron on the upper surface, if undisturbed, unfolds itself against the side walls, carrying with it and holding whatever of foreign substance may be present. Of course, this same process takes place in casting in gray iron. But a chilled surface is nearly always required to be perfect, is generally turned or polished, and any imperfection would at once appear, and the casting would be worthless. Of course there are no means of skimming chilled iron that do not apply with equal force to gray iron. But as my work for many years past has been largely in chilled iron I have been compelled to give much more attention to cleanliness than would otherwise have been the case. And I think I may claim to have fought a winning fight against dirt in iron.

And in the hope of helping some one a little, I will say that if you give the dirt a good chance it will keep out of the mold by virtue of its own character. The dirt is very much lighter than iron and therefore if you provide sufficient room in the system of gates for the dirt to dodge above the inflowing current and behind some obstruction, it

will invariably do so. The down-gate itself is an excellent skimmer if sufficiently large and if kept filled to a point above the surface of the runner. In rolls the pop-gate is often most desirable, as it keeps the surface of the iron constantly agitated and so prevents the dross from clinging to the mold walls, whether these be of sand or of iron. But, above all things, never stop short of success in making clean castings. And now,

WHAT IS CHILLING IRON?

It may be thought that this is a very simple question, easy to answer. But I answered the question, as I thought, some time ago in the foundry department of The Tradesman, and next thing I knew somebody said (also in print) that I didn't know what I was talking about. I don't like to be too positive of my knowledge of a thing, for I realize that I might possibly be mistaken. I have been manipulating chilled iron only for about 15 years, and so haven't had time to learn it all. But, to give you an idea of what I don't know about it, I will say, for many years I was in the habit of melting daily in one cupola, at one heat, from three to five distinct grades or mixtures of irons; from two to four of these mixtures being chill mixtures and one of them being required to be so exact in chill tendency as to give the required chill from mere contact with the sand—no iron chill being used for this particular mixture. One of the mixtures was for soft gray iron, and during all of this time I never knew what I thought to be a non-chilling mixture to chill, save on a few occasions. The No. 2 charcoal iron on these occasions proved to be of that anomalous character wherein the fracture does not tell the truth. Then, during another period of years, I made three mixtures to a heat daily, using many different brands of both charcoal and coke iron, and yet I never learned from experience that anything but charcoal iron was a good chilling iron. Of course, I am well aware that coke iron may be used very largely in the chilling mixture, but I believe that if you produce good results the chilling tendency will be given by something else than coke iron. My experience in handling chilled iron has been had in three different foundries, and in one of these, at least, I was enabled to experiment to my heart's content. I made very radical variations in per cent of charcoal and coke irons and, in fact, I produced chilled castings from coke iron alone. After this, it may sound paradoxical for me to say that I do not regard coke iron as a chilling iron, and yet that is just what I say. To produce chill in coke iron the pig used must be so high in combined carbon as to render the casting product extremely weak.

The tendency to chill is, in coke iron, generally very slight. On the other hand, the chilling tendency in the various numbers of charcoal iron of approved brands is great and approximately constant. So that the operator can make a mixture of charcoal and coke irons that will produce any desired result.

Mr. Keep in his "Cast Iron Notes" in The Foundry, says: (November, '96, p. 124, second column) "Lately it has been found that non-chilling coke iron can be used for car wheels by using portions of malleable scrap, which impart a chill. The chill in such cases is largely obtained, however, by the use of old car wheels."

Again in The Foundry, p. 93, November, 1895, Mr. Keep says: "Some charcoal pig iron will not produce a chill, and some coke iron will. It is not a question of chemical analysis. Some irons that are chilling will show the same analysis as others that are not chilling." If the latter is true the former must be true also. I must say, however, that in about fifteen years of constant practice in the manipulation of chilled iron mixtures, though I have sometimes found a charcoal iron that disappointed me in some measure in not chilling so deeply as I had expected, and though an occasional car load of coke iron has shown an abnormal tendency to chill, yet the line of demarkation between the two has as a rule demonstrated the chilling tendency of charcoal iron and quite as distinctly the non-chilling quality of coke iron.

Of course, charcoal iron is far more costly than coke iron. Fortunately, however, the chilling tendency of some charcoal iron is so excessive that a large per cent. of non-chilling iron may be used in the mixture, which will still have sufficient depth of chill. Charcoal iron alone was formerly used in chilling mixtures. But in recent years coke irons have been much employed as the factor for reducing chill tendency. In my opinion, nothing has been lost by this change, for

you still depend upon the charcoal factor for the chilling quality.

I do not know of any reason why coke iron should not possess the same chill tendency as charcoal iron. I only know that in general it does not. It would not be a matter of surprise, however, if chemistry should in the near future solve this problem for us. It is certain that if any man could to-day produce a chilling coke iron without extra cost the equal of the charcoal product he would not have to keep the secret of his process long to make him the richest man in the world, for the difference between $7 per ton and $14 per ton leaves room for a very comfortable profit.

With regard to chemical analysis and physical test, I do not doubt the value of either. But the great majority of our founders cannot or at least think they cannot, afford chemistry. Whether they are right or wrong, the fact remains that the adoption of chemical analysis will be a slow process. I do not know whether anybody else in the world makes a chilling test of the molten iron before casting it. But I always do; and by this means I am enabled to make an approximately uniform grade of chilled castings throughout the heat and throughout the year. My cupola ladle is large enough to hold a whole charge of iron and I melt it so hot that after tapping out it may stand for several minutes and still be amply hot and fluid enough for casting perfectly. We tap into this ladle and when about three-quarters full a test casting is made upon a chill. This casting, perhaps three-quarters of an inch deep by one inch wide by four inches long, will solidify in less than a minute. It is then immediately plunged into a bucket of cold water, and as soon as it turns black it is broken and the depth of chill appears. If just right the iron is at once poured into the molds; if a little too hard or too soft, more iron is tapped into the ladle and another test taken. Thus we know that every casting we make is just what we wish it to be.

The molding for these tests is done thus: The flask consists simply of a cope part, perhaps three and a half by six and a half inches by two inches deep. The pattern, three-quarters of an inch deep by one inch wide by four inches long, is cast solidly on a cast iron plate, whose length and breadth corresponds with that of the flask. The down-gate, or "pop" gate, of conical shape, is also solidly cast on top of one end of pattern. The flask is three-quarters of an inch thick, so as to make it heavy, thus obviating the need of weights or clamps in casting. Now, a pile of sand is riddled and the flask is set upon the pattern plate, a double handful of sand is thrown in with force, a couple of strokes of the hand ram, strike and expose the top end of the pop gate. The draft of the latter and of the pattern are so sharp that the cope is easily lifted therefrom, and set down in position upon a long planed and oiled cast iron plate or chill. Enough molds can be made and placed upon this chill for the day's use in a few minutes. The tests, after examination, should be placed in regular order upon a shelf, so that next day before making up the mixture for the charges those tests may be closely scrutinized and any variations needed may be made in the mixture. Of course, we make test bars also, every day, and their transverse strength, deflection and especially the character of the crystallization, furnish a constant and efficient guide, which, together with the known excellence of the irons used, leave little to be desired.

Selecting Pine for Pattern-making.

By JOHN M. RICHARDSON.

This wood stands at the head for patterns, being employed universally for all sizes. Of course cherry and mahogany are better; but owing to their comparative cost, are used only in a limited way on quite small work, and for trimming exposed parts of larger standard patterns which are in constant use. Pine is soft and easy to fashion into any shape with edge tools. It is light, and does not have that open, coarse grain that chestnut, ash, oak, and some other woods have, and while it is soft, still it is not brittle and liable to easily chip and sliver on exposed parts. Again it does not have that wonderful tendency to curl and twist, as for instance does white wood.

Ordinarily the grain of pine is straight, and it can be planed with satisfaction. This is a feature of no small moment; for what is more exasperating than to try to plane a piece of wood like lignum-vitae, where the grain runs in narrow stripes, as the plane

slides along, every alternate stripe being as smooth and shining as glass, while the intermediate ones are very much the reverse; then when we turn the piece around and plane in the opposite direction we get a result exactly vice versa, the rough stripes being smooth, and the smooth ones rough. Every wood has its place, fortunately, and lignum vitae works beautifully in the lathe. Another reason which brings pine into favor, and perhaps it is the mightiest of them all, is that it is cheap and plenty. No one can tell any quicker at sight how a given board will work under the tools than the pattern maker who must use it. For this very reason the selection of pattern stock should be entrusted to an experienced person and not left to the tender mercies of the help in the lumber yard. There are certain undesirable qualities in some pine, which we do not want for pattern work, and which can be, for the most part, avoided by a little care; but it is very difficult to do this when the board is rough before being planed at the mill. It is better, I think, to buy the stock planed, for one can then see what he is getting. A shaky piece is to be avoided as useless. This is where the grain seems to be cracked and slivered lengthwise of the board. It is claimed by some to be caused by the wind straining the tree, and sometimes by the way the tree falls when it is felled. I am not an authority as to the cause, however, but realize fully the undesirable effect. Knots are an objection which is self evident, and can be easily avoided, because in plain sight. What is termed sap wood is undesirable, also. This is found toward the outside of the tree, next to the bark, and sometimes an outer board near where the slab was removed, will show sap pretty nearly all over one side, and show scarcely any on the other, except at the edges. Many good boards are sappy at the edges. This is probably the least of the undesirable qualities, and is shown by the color which is usually almost white, although sometimes of a darker shade. In these places the wood seems lifeless and spongy, and is very difficult to work smooth with the tools.

A soft board which works easily is very light, and one would not associate the word pitch with it in any sense. It is also lighter in color, while a hard piece is much heavier, and traces of pitch being clearly seen, while the whole is more yellow in color. A hard piece works very much the nicest in the lathe, and will turn up very smooth indeed, but is not so pleasant to use with hand tools.

Above all things get dry lumber, for no matter how perfect the quality, if not properly seasoned and dried, it will shrink and crack, and cause no end of trouble and spoil the finest of patterns.

Many pattern makers prefer season dried stock to kiln dried. This is open to opinion like other things, but it must be thoroughly dried in some way. When a piece of plank is sawed off it will check at the freshly sawed ends after a time if not properly dried. If it shows any inclination at all to check at the ends, it is not properly seasoned, and not fit to find a place in a pattern.

In storing away lumber ready for use, it is bad practice to pile boards flat, one above the other, for this allows no circulation of air between. Either pile edgewise, or flat, with narrow splines placed at intervals between.

Some pine shows curious short curved streaks which seem to bear some analogy to the marks in quartered oak. If anything, these marks are a little harder than the surrounding wood, and are frequently found in the best lumber and a board having them is not therefore necessarily to be avoided; but the ideal stock for a pattern is light, soft and straight grained, free from all knots, sap, or any irregular markings whatever, and last, but not least, dry, and this last to be emphasized.—American Machinist.

Mechanical Pacemakers.

Our columns show continually how completely we believe in the practical helpfulness of intercommunication between those engaged in mechanical pursuits, and how much also we are constantly doing to promote what is in itself, and in its results, so desirable. There are, however, many who will readily acknowledge some of the actual benefits resulting from mutual communicativeness who still fail to appreciate the full scope and influence of it. It is perhaps first in importance that we should each know all that we can of the best and most advanced means and methods of manufacture, so that the best facilities for doing things may be as widely adopted as possible. It is also important that we should know what standards

of accuracy and excellence are maintained, so that each may do as well as, and strive to somewhat excel, every other, and yet avoid the unprofitable niceties which, though rare, still prove fatal stumbling blocks to the few. There can be, theoretically, nothing too good; but practically there may be, even in machine work, a finicality which no customer will appreciate, which none will willingly pay for, and which therefore will not pay.

But perhaps, after all, the most necessary thing for us each to know of the other, is the pace at which we are going. Isolated contentment is not the best developer of either power or speed, and if velocity is conceded to be desirable, there is no better way to promote it than by diffusing a knowledge of the general pace, and especially of the rate of every flier. We can have no greater stimulus than can be found in the fact that a rival is just a little faster. The greatest astonishment among our foreign competitors is provoked, not by the ingenuity of our automatic machinery, but by the speed at which it can be, and at which it actually is, operated. We can none of us do our best unless we are crowded, and the closer we are pressed, the better will be our speed. There must be a pacemaker, and neck and neck is very different from six lengths apart.

It is a rather curious fact that this actual knowledge of each other's speed can never work but in the one direction. The struggle is, always to be first and never to be last. The laggard never sets the pace, but merely gets left. The struggle to win stimulates to alertness in securing the means of winning. We have only to know that we must pull faster, and that it can be pulled faster, as the other fellow is showing us, to also find the way to do it. Modern methods and modern successes have come more from mutual rivalry in full sight of each contestant than from all else.—American Machinist.

Obituary.

THOMAS REES MORGAN.

Thomas Rees Morgan, president of the Morgan Engineering Co., Alliance, Ohio, died suddenly of heart failure September 6, aged 63.

FRANCIS M. HUNTER.

Francis M. Hunter, one of the founders of the Yeager-Hunter Spring City Stove Works, Spring City, Pa., died on September 5, aged 49.

T. T. FLAGLER.

T. T. Flagler, who died this week at Lockport, N. Y., was President of the Holly Manufacturing Company. Mr. Flagler was born in Pleasant Valley, N. Y., in 1811, and came to Lockport in 1836, and has been prominently identified with the founding and growth of the city. He has been twice elected to Congress, and for many years been identified with the leading interests of Lockport, besides being at the head of the Holly Manufacturing Company; he was also President of the Niagara County Bank and Director of the Lockport & Buffalo Railroad and the Lockport Hydraulic Company.

JAMES REYNOLDS.

James Reynolds, who died at New Haven, Conn., August 22, and who was known to a great many as "Catalpa Jim," was born in Ireland in 1830. When 17 years old he emigrated to America and became identified with the Fenian movement. He was made national treasurer, and was active in this position in raising money and sending men to aid in the invasion of Canada in 1866.

When the insurrection failed he led the secret movement to release the Fenian prisoners who were sent to Australia. He mortgaged his home and his personal property, including his household effects, and even his watch, to raise money to buy and fit out the whaling bark Catalpa. This little vessel crossed the ocean and co-operated with the Irishmen in Australia, who effected the release of the prisoners, and they were safely landed in New York.

Irishmen from all over New England united in a grand banquet to Mr. Reynolds last spring in celebration of the fiftieth anniversary of his arrival in this country. A loving cup was presented to him which bore the names of several hundreds of the best known Irish-Americans of the country.

In the yard of his foundry in East street there lies the notorious Fenian ram which Holland, the inventor of the sub-marine torpedo boat, built and sold to the American Fenians to sink the entire British navy.

Among the Foundries.

The Escanaba (Mich.) Iron Works is building an addition to its plant.

The Elwood (Ind.) Iron Works have increased their working force.

The Aschman Steel Casting Co., of Sharon, Pa., has resumed operations.

The Chattanooga (Tenn.) Plow Co. will erect a $5,000 addition to its plant.

John W. Sullivan, of New York, has erected a large foundry at Sing Sing, N. Y.

The New Britain Brass Co., of Hartford, Conn., has begun work on a new foundry.

S. E. Loy has purchased the foundry recently owned by Jacob Dedion at Aurora, Ill.

Harding & Senbury are erecting a new foundry on North Barr street, Ft. Wayne, Ind.

Groff & Co., stove founders, Pittsburg, contemplate the erection of a plant at Remington.

Geo. W. Brown & Co., of Galesburg, Ill., are reported as intending to increase their foundry.

The Union Foundry & Machine Works, of Mansfield, O., have placed several specialties on the market.

Wm. McClellan succeeds G. H. McKinley as foreman of the Moline Plow Co.'s foundry, Moline, Ill.

The Aetna Foundry & Machine Co., of Springfield, Ill., has increased its capital stock to $25,000.

The Wallace Machine & Foundry Co., of Lafayette, Ind., have lately increased their foundry facilities.

The Dora Furnace Co., of Pulaski, Va., has reopened its foundry and is running it to its full capacity.

The Kinsley Iron & Machine Co., of Canton, Mass., have reopened their works after an extended shutdown.

Jesse H. Cunningham, of Wilmerding, will open the Irwin foundry at Greensburg, Pa., for the manufacture of heaters.

The American Steel Casting Co., of Sharon, Pa., have lately increased their working force in all departments.

S. S. Bent & Son, of Rochester, N. Y., whose foundry has virtually been closed since 1893, will be reopened shortly.

The Iron City Manufacturing Co., of Pueblo, Colorado, have had plans prepared for a new pattern house, 45x60 feet.

The Anderson (Ind.) Brass Works of John Lavelle & Son have lately turned out some heavy bearings for tin mill machinery.

The Hawkeye Foundry, of Iowa City, Ia., operated by B. Tulloss, has increased its facilities for turning out heavy castings.

C. H. Grimm & Co., of Rutland, Vt., have removed to more commodious quarters, made necessary by their expanding trade.

The Pittsburg Ornamental Iron Works will remodel and erect an addition to its plant on Washington avenue and Sedgwick street.

The Auburn Foundry & Machine Co., Auburn, N. Y., has filed articles of incorporation with the Secretary of State. The capital is $25,000.

Several men were badly injured by the upsetting of a ladle of iron in the foundry of the Farrell Foundry & Machine Co., Ansonia, Ct.

James A. Allen, formerly of the Allen Iron Works, of Adams, Mass., is reported as intending to organize a new foundry company in that city.

Capt. Fred Russell has assumed the management of the McGee Iron Foundry at Long Island City, N. Y., in place of Joseph McGee, lately deceased.

W. S. McIntire & Co., proprietors of the Salem (Mass.) Iron Foundry, have purchased additional land to provide for an enlargement in the near future.

The Denmark Agricultural Implement Manufacturing Co., of Denmark, S. C., has lately erected a new set of buildings provided with up-to-date machinery.

S. H. Fink, of the firm of Fink Bros., founders and machinists at Washington, Pa., sailed for Java recently, where he will represent Jardine, Matheson & Co.

The Warren (Mass.) Specialty Manufacturing Co. will erect a brass foundry and engage in the manufacture of pneumatic tools and hardware specialties.

The Alabama Foundry and Machine Works, New Decatur, Ala., have been incorporated with $50,000 capital stock, to manufacture agricultural machinery, etc.

The Clinton Iron and Steel Company, Pittsburg, have blown in their Clinton furnace on foundry iron. New ore bins, tracks and approaches have been constructed.

The Indianapolis Stove Co., Indianapolis, Ind., will erect a stove foundry at the corner of Hill and Columbia avenues at the intersection of Pendleton pike, to cost $9,500.

Col. Frank T. Lee, of New Haven, Conn., is reported as intending to organize a company for the purpose of establishing a plant for the manufacture of ductile cast iron.

The Highland Foundry, 1223 to 1231 Indiana avenue, Denver, Colo., are building a foundry 35x125 feet, and will also add a mounting shop to their works at an early date.

Lewis C. Norton, of Everett, Mass., has organized the Norton Iron Works for the manufacture of architectural iron and brass work. Suitable buildings will be erected at once.

John E. Brine has purchased of C. E. Hutchinson the property north of the Pierce & Pendergast mill, at Syracuse, N. Y., and will soon erect a machine shop and foundry on the same.

At a special meeting of the stockholders of the Oriskany (N. Y.) Malleable Iron Co., Geo. A. Baer, vice-president, was chosen president to fill the vacancy caused by the death of George Graham.

The Brown-Ketcham Iron Works at Indianapolis, Ind., has been compelled to temporarily increase the capacity of its foundry in order to fill several contracts requiring immediate completion.

The Midvale Foundry Co., of Allentown, Pa., owing to increasing business, is compelled to enlarge its works. A two-story pattern shop will be erected, whose dimensions are to be 50x100 feet, and an extension to the present foundry 68x109 feet.

T. Harold Townsend has purchased the interest owned by S. McLean in the Waterville (N. Y.) Foundry and Manufacturing Co. The firm now consists of A. D. Kimball and T. H. Townsend. The name will remain the same.

The William S. Haines Company has been incorporated at Camden, N. J., with a capital stock of $100,000 to conduct a business of general iron founding. The incorporators are W. S. Haines, W. A. Levering and Erastus Wilman, of Philadelphia, and Alexander Duer, of Camden.

The new Dubois (Pa.) Iron Works were put in operation lately. The plant was erected this season by John E. Dubois, and will employ from 250 to 300 men when completed. The building is of brick and stone, 80x500 feet. A blacksmith shop and foundry will be attached, and the plant, when fully equipped, will cost probably a quarter of a million dollars.

Baker Bros., Toledo, O., the foundry and machine men, have purchased of E. D. Libbey a tract of land fronting on Post and Islington streets, 441 feet on the former and 313 feet on the latter thoroughfare, which is to be improved by the erection of several buildings in which their foundry and machine manufacturing business is to be conducted on a generally enlarged scale. The main machinery building is to be 100x200 feet; at the rear of this will be another building 40x110 feet; the foundry, 70x150, will be built and also an annex 40x100 feet. All the buildings will be one story high, constructed of steel, with all the most approved and modern appointments.

Fire Fiend.

Torrance & McIntosk, of Monmouth, Ill., had their works destroyed by a recent fire.

Stark's Iron Foundry at Manchester, Va., was visited by a small fire recently.

The Lehigh Valley Foundry at Weatherly, Pa., was badly damaged by a recent fire.

Shaw's Foundry at Eau Claire, Wis., was damaged to the extent of $3,000 by fire September 3.

The foundry owned by A. E. Shorthill, of Marshalltown, Ia., was slightly damaged by fire August 27.

The Attalla (Ala.) Foundry & Machine Co.'s plant was entirely destroyed by fire August 21. Loss reported $10,000.

The Walworth Run Foundry Co.'s plant at Cleveland, O., was destroyed by fire September 1. Loss probably total; partially insured.

The foundry and machine shop of B. Suffon & Son, at Peebles, Ohio, were totally destroyed September 7.

The Anniston (Ala.) Pipe & Foundry Co. had their plant destroyed by fire August 29. Loss reported covered by insurance.

The Altoona (Pa.) Foundry Co., managed by Joseph Bain, had its plant completely destroyed by a fire September 4. A large amount of machinery and patterns were badly damaged.

The Kansas City Car & Foundry Co., of Armourdale, Kas., had its foundry destroyed by fire August 25th. Loss about $15,000, fully insured.

J. C. Harrington, of Oskaloosa, Ia., suffered the loss of his foundry by fire August 24. Loss estimated at $2,500, with no insurance. The shop will be rebuilt at once.

The foundry and machine shops of the John Rice & Bro. Co., at Stevens Point, Wis., were badly damaged by fire August 31. The loss is estimated to be covered by an insurance of $9,000.

How Things Look to One in the Business.

Before leaving for Europe, Mr. Archer Brown, of Rogers, Brown & Co., was interviewed by the New York Times as to the situation in the iron trade. To the question, "Is the recent advance in pig iron justified by market conditions?" Mr. Brown replied:

"Unquestionably it is. Stocks commenced to decline in June, and have run off probably 150,000 tons out of about 1,000,000 tons in the past three months. They are declining today at a more rapid rate. The accumulated stocks of foundry iron in Alabama, in Chicago, in Buffalo, and in the Mahoning and the Shenango Valleys have dropped away in the past six weeks at the rate that the furnaces themselves have hardly appreciated.

"I greatly deprecate any rapid or artificial advance ,but every indication now points to a scarcity of both Northern and Southern foundry irons before the year is over. The trade at large has been impressed with the idea that there was an immense reserve capacity which could be made active at a moment's notice, and that there were large unsold stocks. As a consequence buyers have not been taking hold freely. Of about 4,000 active foundries in the United States it is doubtful if 500 have as much iron bought as it was their previous custom to carry. The remaining 3,500 will need to replenish heavily as the fall months come on if business continues to improve as it is now doing.

"At the first sign of scarcity consumers get excited and bid for twice as much as they actually need; thus artificial conditions are created and a so-called boom comes on when there is no occasion for it. And everybody knows that a boom is against the best interests of the iron trade. But history has repeated itself at almost regular intervals in the iron trade in this particular, and will doubtless continue to do so as long as pig iron is produced and melted.

"The first 25 cents per ton advance comes the hardest of all. Furnace companies which have found it hard to sell at prices perhaps below cost lack confidence, their own agents and brokers are skeptical, and buyers are serenely apathetic. But when the more sagacious and well-informed make large contracts at a small advance and a further rise comes in the natural order, bears change to bulls over night and the material is eagerly demanded at full prices. That is exactly what we are seeing to-day. It is easier to sell a thousand tons to-day at top prices than it was a hundred tons a month ago at the bottom.

"How much further the American iron markets will improve depends entirely on the broadening of commercial business, manufacturing, and particularly new construction of every kind throughout the United States. It can only be said that the prospects at the moment are as bright as the most optimistic could desire."

A 50-Ton Traveling Crane.

The 50-ton traveling ladle crane installed in the new basic steel plant of the Buhl Steel Co., Sharon, Pa., has several features that will make some details concerning it of interest. It was built by the Shaw Electric Crane Co. of Muskegon, Mich., which has supplied this type of crane to several steel companies, including the Illinois Steel Co., the Apollo Iron & Steel Co. and the Crescent Steel Co. A similar outfit was built for the Nicopol-Mariopol Mining & Metallurgical Co.'s plant at Mariopol, Russia.

FIG. 1—FIFTY-TON ELECTRIC TRAVELING CRANE (GENERAL VIEW).

In the illustrations Fig. 1 shows a general view of the crane. Fig. 2 shows the details of the main trolley, Fig. 3 a cross section through the crane, showing both of the trolleys in position, and Fig. 4 the auxiliary trolley. The main trolley, as will be seen from these illustrations, has a double-chain hoist, being mounted on top of the girder and equipped with two hoisting drums, one of which overhangs each side of the girder, so that the chains will clear in passing to the bottom block below. This trolley is of 50 tons capacity, while the auxiliary one, which runs between the girders beneath the main trolley, has a capacity of five tons. Both of the trolleys traverse the entire length of the bridge, the movement of neither being limited or affected by the other. The carriage of the main trolley is built up of steel and is operated by two motors, one for the hoisting and a second for the traverse. The gears are all cut, with the exception of the main drum, and all pinions are made of cast steel.

Both trolleys are equipped with the Shaw patent brake ,the operation of which renders impossible the running down of a load any faster than a motor is revolved in the direction necessary for this operation. In addition to this, an electric brake is provided which is applied automatically immediately on the current to the hoisting drum being interrupted, whether by the operator or accidentally. On the crane an independent reversing electric motor is provided throughout for each movement. The auxiliary trolley has two of these motors, and one is provided for traversing the girder. One of the claims made for this crane is the easy access to all the operating parts. The crane is built with a factor of safety of not less than five when it is working to its full load; and on such parts as are subjected to wear, this factor is increased. The motors are of slow speed, requiring few reductions in gearing. These motors are of special design, and are very compact, all sizes above five h. p. being of the multi-polar type. The frames are of soft steel castings, and all are made in a single piece. It is stated that between 300 and 400 of these motors are in operation in

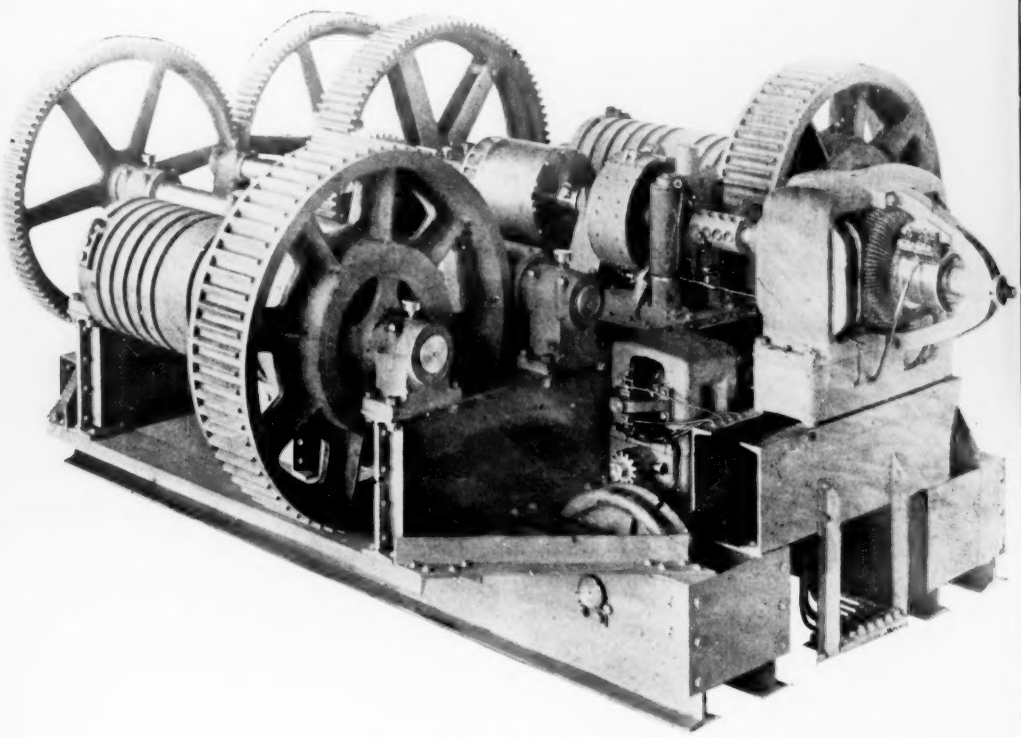

FIG. 2.—MAIN TROLLEY.

crane service, and not a single failure has ever been reported. The controllers are also manufactured by the builders. No combust-

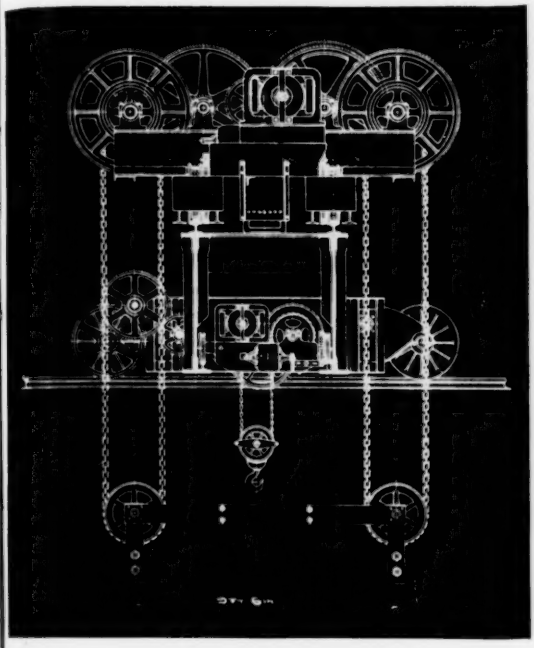

FIG. 3—CROSS SECTION.

ible material is used, only mica and slate being employed for insulation.

All sheaves throughout are fitted with loose bronze bushings. The bridge and also

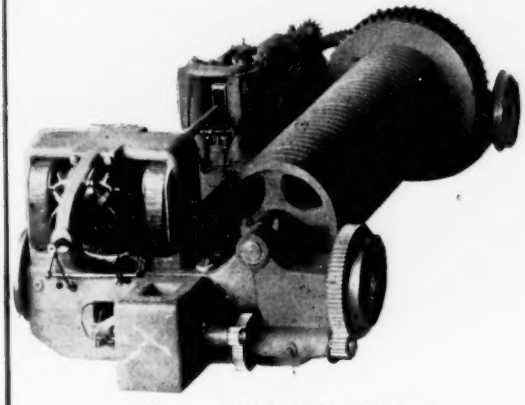

FIG. 4—AUXILIARY TROLLEY.

the trolley truck wheels are made of charcoal iron, and have the treads chilled and ground. The operating platform of the machine, as can be seen from the illustration, is suspended beneath the girder near one end, and all movements are controlld by means of levers, a separate lever being provided for each movement. The movements are entirely independent, and the speed of one is in no way controlled or affected by that of another.

The auxiliary trolley of this crane is used for tilting the ladle in removing slag, or for any light work such as the handling of ingot molds, flasks, and like service about the cast-house.

Why We Should Have Shorter Hours.*

In rising to address you upon this occasion, I cannot refrain from expressing my congratulations upon the success that has attended the efforts of some of your leading spirits in having thus brought together such a representative gathering of the foundry interests of this country to discuss questions of common and general interest, not from a restricted local or sectional standpoint, but from the broader and more comprehensive one of a national association. It must convey to your minds, as it does to mine, another illustration of the effectiveness and utility of organization among those whose interests are so nearly identical. These meetings and the discussions which follow will, I feel assured, be productive of much good to the foundry interests. And when I say foundry interests, I do not wish to be understood as referring simply to the interests of employing foundrymen, but as well to the interests of those who occupy an equally important position in the industry, namely, the iron molders, whose organization I have the honor on this occasion to represent.

It was with pleasure I remarked in looking over your official programme that you were already actively engaged in considering how best to promote the mechanical ability of the molders of the future. In that effort you have my heartiest sympathy. I also observed that a similar committee was engaged in devising means whereby labor troubles might be avoided. In that also you have my heartiest sympathy and the sympathy of those whom I represent. The strike is but a relic of those barbaric times when

* Address delivered by Martin Fox, President of the Iron Molder's Union, before the Convention of the American Foundrymen's Association, Detroit, May, 1897.

the principle of "might is right" was applied to questions deserving of measurement by a higher and nobler standard.

My presence with you on this occasion, however, is not for the purpose of intruding my opinion or advice on these matters, but to bring to your notice a reform whose introduction is year after year becoming more imperative both in the interests of economy and humanity. The establishment of a shorter workday, preferably an eight-hour workday—for that is my theme—has occupied a prominent position as a reform for more than a generation. In its earlier history, however, it did not command that general attention nor occupy that foremost place in the industrial world that it does to-day. In these early days, science and invention—the progeny of man's boundless genius, had not yet opened up to us those magnificent possibilities that have developed so rapidly before our astonished gaze during the last quarter of a century. To be sure there were, in those times, periods of business depression; there were times of suffering and loss, but the struggle for existence had not yet acquired that desperate intensity that has become such a striking feature of these later years. This, to some extent, may be taken as explaining the slow progress that has been made towards the realization of a general eight-hour work-day. The cruel experience of the past few years, however, has given the movement an impetus that nothing else could have done. Employers and employes are alike casting their eyes about to discover the cause of a condition of trade that carries with it loss and ruin to all interests concerned. Idle labor disconsolately walks the streets, capital lies idle in our bank vaults, and expensive plants rust and decay through lack of demand for their product. From all sides arise anxious inquiries as to the cause of this state of our industries, and not the least of these inquiries comes from the working man to whom idleness means loss of comfort, loss of home, and sometimes even loss of life. I assert boldly, and I have no doubt that you will agree with me, that this condition is a stain on the fair supremacy of American genius and civilization. It leads us to think that we have spent too much time as a people in devising money-making and labor-saving methods, and too little in the perfection and elevation of our American manhood.

The argument is not a new one to any of you that the demand for goods depends entirely upon the purchasing power of those who consume them. It follows, therefore, that if that purchasing power be seriously curtailed, or what is practically the same thing if the number of purchasers be materially lessened, the demand will be affected adversely in like proportion. If, on the other hand, the purchasing power be augmented, by inverse reasoning we would experience an enlarged demand and a more healthy and more progressive condition of industrial interests. To promote and accelerate the growth of this demand may be said to constitute the chief argument, from a business standpoint, in favor of an eight-hour workday.

It can not be disputed that all business would be benefited by a decrease in the number of idle workers. Put more men to work and more wheels must revolve, and as a corollary to this proposition, that five men working eight hours each per day will create a greater demand for the products of industry, than four men working ten hours, and the fifth depending on chance or charity. It would seem, therefore, to be the part of good business policy to lend assistance to any movement having such an end in view.

In asking this association to co-operate with the Iron Molders' Union in its efforts to establish an eight-hour workday in the foundries, I do not appeal to you on mere sentimental grounds or as an enthusiast who sees in the eight-hour workday the panacea for all the ills from which business men and working men alike suffer; but rather on the ground of good business policy, on the ground of business necessity. Many of you will recall the strong arguments advanced in favor of an eight-hour workday by Mr. R. A. Hadfield, of Sheffield, England, in the course of an address delivered before the Philadelphia Foundrymen's Association. By practical test he claimed to have proven it both the most profitable and most productive system. If this be true as applied to British iron industries, why should it not prove even so in America?

We sometimes hear the argument advanced that plants have been built and

equipped in conformity with the requirements of a ten-hour system. Well and good. But where is the business man among you who would hesitate to put in new appliances or introduce more economical methods simply because his plant was originally intended for an inferior system? These same arguments were advanced by the manufacturers of a former generation in answer to the demand for a reduction of the hours to ten, and cannot, at this late day, be seriously entertained.

If, however, the necessities of trade demanded that all plants be run at their full capacity every available working day in the year, there would be some reason to pause before so materially deranging the economy of business as would be involved by a twenty per cent. reduction of the working hours. But the actual facts are so far removed from such a premise, indeed, the opposite is so generally true, that the mere prospect of creating a healthier demand should operate in your minds in favor of the reduction in the hours of labor that we advocate. There may be individual cases, it is true, when in good times a plant is run at its full capacity all the year through, but I am greatly mistaken if you will not agree with me that such a case is the exception rather than the rule, so that we are justified in assuming that the foundries of this country in the aggregate could under normal conditions turn out an equal or even greater quantity of work in the year under the eight-hour system, by reason of the increased continuity of employment, without any material extension or enlargement of their present plants. But even if the introduction of this system as some contend would necessitate the purchase of more real estate and the erection of additional molding space to accommodate the increased staff, answer me, if even that would not be infinitely preferable to the desultory and unprofitable style of operation, and if the capital thus invested would not be more than made up by an enlarged and healthier demand? Dodge the question as we may the principle remains, that the interests of capital and labor are best conserved when the wages of the mass of the people are highest and most widely distributed.

I have dwelt hitherto on the favorable influence of the shorter workday upon business interests, but there is another of equal importance to be considered, and that is the moral influence on the workman himself. There was a time when employers contended that an increase of leisure would simply give increased opportunity for drunkenness and dissipation. Actual experience has proven that this is not the case. Give men "leisure to live, leisure to love, and leisure to taste our freedom," and you make better men of them. You lift them upward in the social scale and instil in them increased desire and increased strength to raise themselves out of the degradation into which adverse fortune has sometimes driven them. The leisure of industry cannot be compared, in its effects to the leisure of involuntary idleness. The one elevates, cultivates new tastes, implants new ambitions, broadens the mind and makes a better citizen; while the other degrades, defiles and imbrutes.

As year follows year, the effectiveness and productivity of labor is ever being increased. It is being increased out of all proportion to the increase and demand contingent upon a cheapening of production, and as the hours of labor have not been reduced in like ratio, it follows that there are constant and alarming additions being continually made to the army of the unemployed. Is it not the height of folly for an enlightened people to continue in this suicidal course? Can we go on forever disregarding the groans of suffering coming from those whom man's genius is condemning to a life of misery and want? Can we wonder that these cries of despair come dangerously near to becoming, at times, the angry shouts of anarchy and revolution? Again I say it is the part of wisdom to lend an attentive ear to the pleadings of those of our people who complain that society, despite their willingness to labor, refuses them an opportunity and ignores their necessity. The working men of this country are listening and desire as a first step to share with these their opportunity. Are you, members of this National Association of Foundrymen, ready to assist in giving effect to this desire?

I do not forget, however, that it is much easier to formulate a desire or demonstrate the necessity of a reform than to put it into practical operation. I do not forget, either, that I am addressing an audience of experienced business men who are perhaps more keenly alive to the difficulties to be over-

come than I can possibly be and who, while sympathizing sincerely with us in our efforts to share with our unfortunate fellow-workmen, our opportunities to earn a living, and realizing the general good that would arise from such a course, nevertheless hesitate to give their sympathies practical effect. I repeat I do not forget these facts. But how are we to overcome difficulties if we do not boldly seek to find them? The molders' organization is alive to the fact that a change of the character advocated is one of those which demands that consideration be shown to the interests of the employes involved; and as if in sympathy with your own desire to formulate a plan whereby labor troubles may be avoided, I appear before you chiefly to secure from you an expression of opinion upon its establishment in the near future, and to obtain your co-operation with a view to advising together how best to surmount the difficulties in the way. If we can come together in cases of this kind and discuss them free from prejudice and with a single eye to the welfare of all interests concerned, we will have taken a most advanced step towards avoiding the friction arising from conflicting purposes.

But returning to the more immediate subject (I desire to deal briefly with one or two of the practical objections that might be raised to the eight-hour workday), I have already given my opinion on the capacity of the foundry plants in the aggregate and will not again dwell upon that phase of the subject. There arises the question—shall this reduction in the hours of labor be with or without a corresponding reduction of wages? This is a serious question, too. On the one hand it would effect a very material reduction of incomes already none too adequate for the demands upon them; and on the other it would materially increase the cost to the consumer. If it were possible to inaugurate the eight-hour system, simultaneously, in all the foundries of the country, I would unhesitatingly advocate the reduction of the hours without a corresponding reduction of wages. But that we know to be impossible and if, in the face of that knowledge, workmen still seek to exact that condition from employers who are willing to test the eight-hour system, it seems to me that it would be placing them at a very serious disadvantage with their competitors, unless, indeed, their men produced as much in eight hours as they formerly did in ten, and in that case the reform would be robbed of much of its economic value. I am, however, firmly of the opinion that the wage question would ultimately readjust itself, and feel justified in supporting the movement conditional upon the proportionate loss of wages. It might be urged against this, that while a mechanic receiving fair wages could get along at the reduction, the laboring man earning $1.00 or $1.25 per day is not so fortunately situated. This, I freely admit, appears to be a valid objection, and commands our sympathetic attention. But I question if at the end of the year either in the case of the mechanic or the laborer there will be any very material reduction in his annual earnings, a large portion of the seeming loss being made up by greater continuity of employment. It is but reasonable to assume, too, that as production conforms itself to the new conditions and the demand for goods increases in response to the new impulse, prices will stiffen and employers be enabled, without inconvenience, to raise the wages in like proportion. This is perhaps the most delicate feature of the problem before us and the one that will require the greatest mutual consideration in its treatment. The question of wages is often the rock upon which our good resolutions are broken, it is the one that is the most closely and jealously watched by both parties; but again I contend that consideration begets consideration, and if each treats the other with proper courtesy and respect, it is not too much to expect that even the wage question may be safely gotten over.

Another contention may be that at certain seasons it is imperative that plants be run to their fullest capacity, while at others employers might be willing to make six or even four hours a day's work. This would be peculiarly the case with the stove and heater trade; and yet I am certain that with a less spasmodic demand than that which exists under present conditions, it would be more possible to make provision at other periods of the year for a trade that is now nervously crammed into a period of three or four months. Many of these objections that might be seriously urged against the inauguration of an eight-hour day will be found to yield readily to the

resourcefulness of a management in hearty sympathy with the movement. The great point to be made after all is to secure the sympathetic co-operation of employers. With management and working force in thorough accord, there is no difficulty that will not ultimately be successfully overcome.

There is but one other feature of the eight-hour system to which I would briefly call your attention at this time; I refer to the increased effectiveness of labor when employed for a shorter number of hours. To compute the importance of this feature would be a mere matter of speculation, and yet it is bound to prove a very material factor in the success of the eight-hour system. All who have had any practical experience in its operation agree that labor under these conditions becomes more productive, some going the length to assert that they have secured as good net results from eight hours' work as from ten hours. It is a certainty that greater rest conduces to greater effort, but with my knowledge of the physical strain already upon the molder, generally speaking, I am not over sanguine that this will prove true in his case, to any considerable extent at least. Of course new subdivisions of the work and new applications of effort may be introduced that will tend to this result, but as I say, its importance can only be vaguely computed until tested by actual experience of the operation of the system.

In conclusion I would urge upon the members of this association that they give this question their earnest individual consideration. I would urge them to view it dispassionately from the standpoint of a business man, of a lover of his fellow-man and of a citizen. Let them compute in their own minds the influence it would have in effecting a permanent improvement in trade. Let them consider its general effect upon and its applicability to their own establishment. Let them examine for themselves the injustice wrought to so many of our citizens who have been forced into involuntary and degrading idleness and have become a charge on the charitably disposed, not because of any physical disability or unwillingness to work, but by the insane policy of their fellow-man in continuing to work long hours despite the fact that science has so wonderfully increased the productivity of man's labor that he can supply all his multifarious wants by fewer hours of effort. Having done this, then make answer to the query—shall we lend our aid in the establishment of an eight-hour workday?

I sincerely commend to your consideration this important question. I trust you will approach it without prejudice and speak out freely your honest convictions. It is proper that labor and capital should commune together and mutually assist in promoting a reform that is fraught with so much consequence to our industrial community.

I can but feebly express my appreciation of the courtesy extended to me by your association, and my gratification at having been thus privileged to bring to your notice on behalf of an important section of your employes a subject that has now become a vital one. I am pleased to know that some of you look favorably upon the movement, and while my paper may have done scant justice to so important a theme, I look to those friends of the eight-hour workday to keep it ever prominently before your meetings till a call shall be issued to representatives of our respective organizations to meet together to devise means and make arrangements for giving it practical effect. On my own behalf and on behalf of those whom I represent I thank you for your kind attention, and trust my effort will not prove unavailing in arousing your sympathy and securing your co-operation in behalf of the eight-hour movement, and I further express the hope that it may inaugurate a movement that will assist us in the future to a better understanding and respect for each other and our interests.

Wrought Iron Melting in a Coke Hole.

In these days of regenerative furnaces, a consideration of the coke hole of our forefathers, with its large fuel consumption and low efficiency, may seem like taking a step rearward. A little reflection will show, however, that notwithstanding the advances that have been made in economically dealing with large masses of metal, when it is desirable to develop a high temperature on a small scale (as, for instance, on experimental work) we must still resort to the old-fashioned coke hole. Consequently, a record of

experiences in this line may prove useful as well as interesting.

The firm with which the writer was connected were contemplating the erection of a "Mitis" plant, but before investing capital wanted to be sure they could turn out a satisfactory metal; hence the experiments. When we first commenced we had trouble with such high carbon materials as old files, hammers, chisels, etc., the melting point of which is low compared with that of the non-carbureted charges we afterward reduced. We had no data to work on, and of course had to pay for everything we learned, and by the time we got through we considered we had acquired quite an education on such work. There were no especial peculiarities about the furnace we were using. It was an ordinary affair, consisting of a boiler iron shell lined with fire brick and connected to a 40-foot stack. But crude as it was, we ultimately produced results that none of the more modern gas and oil furnaces that we tried could approach, at least on so small a scale. Our first experiments were with high carbon steel. We imagined that by annealing we could so soften the castings that they could be machined, but found out our mistake. There was nothing for it then but to melt down low carbon steel, if we wished to turn out soft castings in that metal. Our experiments with the hard steel had taught us that the brass furnace we were using was too shallow. Our first care was to deepen this from a depth of 27 to 36 inches, the diameter being 26 inches. The material we wished to melt was horse-nail clippings (Swedish iron) and boiler punchings, and at the first trial we were successful. In charging the furnace we stood the crucibles upon a base 9 inches in hight. This base at first consisted simply of three pieces of fire brick placed one upon the other. These were put in position on the grate bars before lighting the furnace. After the fire was started we allowed the coke to burn down until we had a solid bed of fire, level with the top of the base, when the crucible was put in and coke placed around the sides. When this had become heated to a cherry red the furnace was filled up with coke, burying the crucible to a depth of 4 or 5 inches. The furnace cover was now placed on and sealed with sand and the furnace left for 45 minutes. At the end of this period the coke on top of the crucible was heated to a bright red, while around the sides it had attained a white heat. The red-hot coke on top of the crucible was now poked down to fill the vacancies around the sides where the coke had burned away, fresh coke was thrown on top again, and the furnace re-sealed and left for another 45 minutes. This operation was repeated at the proper intervals for five hours, at the end of which time the metal was sufficiently hot to be removed and poured.

The most important part of the whole process is the poking down, as a little laziness on the part of the melter will make all the difference between success and failure. No half measures will do; it is not enough to stand two or three feet away and jab at the coke; the bar must be held perpendicularly and driven through the fire all around the crucible, touching the grate bars at every stroke. In this manner good hot fuel is always kept around the base and bottom of the crucible. Unless this is done the fire will die out to a hight of about eight inches above the grate, the bottom of the crucible will chill, and the metal will be melted on top and remain solid in the bottom.

Another cause of failure is found in the condition of the furnace. As may be expected, the intense heat rapidly cuts away the lining. When this has become ragged, slag-covered and barrel-shaped, it is an utter impossibility to take out a heat, as the furnace will scaffold—that is, a solid clinker will form from the walls of the furnace to the top of the base. This clinker is so tenacious while hot that it is a difficult matter to break through it, even with a heavy bar and sledge, and even should it be broken after much exhausting labor it will form again before the metal has a chance to melt. The writer has known instances of furnaces in this condition devouring coke for six or seven hours, producing on the top an intense heat, yet the contents of the crucible would be as solid at the end of this time as when first put in. The only remedy is a new lining. The furnace, to do good work, must be kept in good order, when, if intelligently managed, it will produce results that the most expensive furnaces will find it difficult to surpass. Another trouble we had to cope with was caused by the base. The common fire brick even of the best grade would melt and the pot would fall over, and being softened by the heat would be broken by its own weight pressing against the sides of

the furnace. We then tried brick that had been taken from the worn-out lining of a blast furnace. This withstood the heat better, but caused annoyance by sticking to the bottom of the crucible, making it both difficult and dangerous to pull out the pot. We then tried the bottoms of old crucibles cut off to a suitable hight. These gave more trouble than anything we ever tried, as they became so firmly cemented to the crucible that it was almost impossible to detach them, and unless detached it was equally impossible to get the pot out of the furnace while the metal was sufficiently hot. This was caused by the base being wider at the grate bars than on the top, where the crucible stood, as the old pots were cut off at the bilge and placed bottom upward, consequently the coke wedged itself between the base and sides of the furnace and practically made one solid mass. Silica sand, charcoal, and everything else we could think of were tried to prevent fusion of base to crucible, but without avail. As it was the cause of so much trouble, we then tried to melt without the base. A bed of coke was placed on the bottom of the furnace of such a depth that when the crucible was placed thereon its top was level with the mouth of the furnace. Coke was placed around the sides, and as the fire burned and the pot sank, more was placed on top in the usual manner. The trial proved a failure, however, as the coke beneath the crucible burned away so rapidly that the latter reached the grate bars before the metal was anywhere near melting. The pot was then lifted out and another bed of coke placed on the grate bars, the crucible replaced and recoked. Of course the crucible and contents were chilled by the cold fuel, but still retained a considerable amount of heat, and it was on this we built our hopes, but all in vain; the result was as before. We then tried anthracite coal in the same manner and with the same results. Finally we discovered that if the furnace was kept in good condition, and the poking down was thoroughly accomplished, so as to keep a good heat around the base and bottom of the crucible, the two never stuck, because the cementing slag, being kept fluid by the heat, offered no resistance when the crucible was raised.—C. Vickers, in the Iron Age.

Best Metal for Cylinders and Valves.

At the recent convention of the American Railway Master Mechanics' Association, one of the members gave a mixture used by the Norfolk & Western road in making metal for cylinders, valves and valve seats. This mixture consists of 20 per cent steel castings, old steel springs, etc., 20 per cent No. 2 coke iron, and 60 per cent scrap. From this can be got a good solid metal, and in cylinder castings there seems to be less trouble from honeycombing, and the metal finishes more nicely than the ordinary cast iron mixture. The mixture shows very regular results, and is about 24 per cent stronger than the ordinary cast iron mixture.

Silicon	1.51
Manganese	0.33
Phosphorus	0.65
Sulphur	0.068
Combined Carbon	0.62
Graphite	2.45

Another member in speaking on the same subject, said: During the last two years we have been thoroughly investigating the character of the iron best adapted for the use of cylinders and valves. After a carefully conducted and elaborate series of tests, we settled upon the composition having the desired physical properties, and then calculated the cupola charges, disregarding entirely the brands or furnace grading of the irons, using our tests of the iron together with our knowledge of the losses that occur in melting as the basis of such calculations.

It was clearly shown that in order to have castings of uniform quality considerable care must be used in charging the cupola, the irons composing the different charges must be thoroughly mixed, otherwise the small pieces of metal or that having a low melting point will be first melted down, giving castings of entirely different characteristics from the same charge. Over 10,000 tests have been made in all, and while all the results have not as yet been systematically tabulated with a view of establishing a relation between the physical and chemical properties of cast iron, we have gone far enough to remove all doubt of the existence of such a relation. There is also quite a definite relation between the strength of the iron and the wearing properties, but it is wrong to as-

sume that the harder the iron the better the wearing qualities. The shrinkage of an iron is generally assumed to increase with the strength, but this is not true with a properly mixed iron, for we can regularly run irons up to 32,000 or 33,000 pounds without increasing the shrinkage; on the other hand, the iron that gave us the greatest trouble from shrinkage was an extremely soft, low tensile iron, 18,000 pounds. Our experience indicates that with proper composition an iron can have as high a tensile as 35,000 pounds without danger of the cylinder cracking. The tendency to crack bears a more definite relation than to the hardness.

Regarding the tests in detail, perhaps the most interesting are the abrasion or wearing tests. It will be noted that up to 28,000 pounds the wear decreases rapidly as the tensile increases. The best wearing material ranged in tensile strength from 28,000 to 32,000 pounds per square inch, but within those limits a given increase in strength did not show a proportionate increase in wearing qualities.

Regarding the chemical properties, there are perhaps more misconceptions concerning sulphur than any other element. Any defects that develop are invariably attributed to sulphur. We, however, found that an iron is undesirable for use in cylinders unless it contains a minimum of .07 per cent, and that it really exerts beneficial results up to .12 per cent. We aim to have our cylinder mixtures conform to the following specification: Tensile, 27,000 to 33,000 pounds; combined carbon, about .6 per cent; manganese, about .35 per cent; phosphorus, .6 to .9 per cent; sulphur, .07 to .12 per cent.

A. Whitney & Sons, Philadelphia, recently received a letter from J. C. Shields, superintendent of the Mineral Range Railway Co., and the Hancock & Calumet Railroad Co., Hancock, Mich., telling of the good record of a pair of Whitney wheels, recently taken from a car after a continuous service of 24 years. They were worn but one-quarter inch on the tread. The mileage was over 159,000. The road is a narrow gauge and the wheels were used in freight service. Much of the roadway is through very hilly country and severe cold weather prevails half the year. The record illustrates the wearing qualities of good chilled cast iron wheels, made in the day when charcoal irons were the invariable car wheel mixture.

Economy in the Brass Foundry.

B. C. VICKERS.

Little holes empty great vessels, says an old but truthful adage. And very often the brass foundry is only a little hole compared to the rest of the factory, but through it considerable leakages may occur if care is not exercised. The sources of such leakage are numerous. We find them in the handling of the crucibles, both in and out of the furnace, and in the charging and melting of the metal, in the spillings on the floor and in the skimmings of the "pots," and also in the use of skilled labor on work requiring no skill. Most practical men are aware that crucibles should be kept in a warm place, and should be heated to a temperature of not less than 112° before being placed in a hot furnace, but how often do we see such simple rules neglected, with the result that brand new pots are often lost through flaking. It is an easy matter to so place the cold metal in the pot that when melting the sinking mass shall not act as a wedge and burst the crucible, but it is not always done. A leaking pot is always a loss, apart from the loss of the crucible itself, metal is vaporized by the heat, and lost by absorption by the fuel. The practice of throwing additional metal into a pot already partially filled with melted metal, is anything but an economy, as the melted metal splashes just the same as water does when a stone is thrown into it, and these splashes are lost amongst the fuel. It may take a little more time to use tongs, but it is a gain. Then sometimes we see crucibles taken from the fire partially filled, when just as easily they might have been wholly so. This increases the cost of melting on every pound of metal, as both fuel consumption and waste of crucible are the same in either case. Another source of loss is found in the practice of melting metal, irrespective of the progress of molding. In such cases the metal is often held in the furnace for hours before being required. Aside from the waste of fuel, the loss may not be of much importance when the metal is kept at a low temperature; but when, as often happens, it is allowed to boil

and bubble, the loss from vaporization is considerable, but the chief loss will be found in the fact that metal so treated is a most fruitful cause of porosity in the castings.

In a certain foundry in which, a few years ago, the writer was employed, the loss from the causes above enumerated must have amounted to several hundreds of dollars per annum. This firm made a specialty of heavy brass and bronze work, and conducted operations on a large scale. The crucibles were purchased by the car load, and no smaller size than a "hundred" pot was used. The flat top of the furnace flue was a very convenient, and proper, because warm, place for storing them. As this flue would not hold all, the remainder were placed in an old wooden outbuilding, where they were more or less exposed to the vicissitudes of climate. Now anyone would suppose that the melter would have known enough to have used the warm pots first, and have replaced them on the flue by the damp ones from the outhouse. But no! those crucibles on the flue looked so nice stacked up there that he wanted to keep them undisturbed as long as possible, and so he would go to that outhouse and fetch a pot when needed, and the result? Well, the crucibles were blamed. They also used to "pick over" the ashes from the furnaces and the skimmings from the pots. Every morning a man would shovel them into a wheelbarrow, picking out those pieces of metal that obtruded themselves too prominently. The contents of the barrow were then dumped into the marsh, around the factory, for filling. In consequence it was no unusual occurrence for the workmen, when idling away the dinner hour, to uncover pieces of brass, scaling anywhere from an ounce to a pound. A "brass" mine on the site of that foundry would have been quite a profitable undertaking. The above may be an extreme case, but it is nevertheless a fact. It is only fair to mention that the firm learned to do better as they grew older and times grew harder.

Most foundries will find it more economical to sell their ashes than to attempt to extract the metal therefrom themselves. In such a case they should be carefully picked over, and any clinkers suspected of containing metal should be put aside. These and the skimmings should be put into the tumbling barrel along with the castings. The modern wood-lined tumbling barrels are the only ones that should be used; they are more expensive to install, but will soon pay for themselves in the saving of metal and the increase of business consequent upon the better appearance of the castings. In these tumblers the contents are washed, by water conducted through the hollow axle. This water then escapes into a shallow tray or settling pan placed under the tumbler. The escape pipe projects three or four inches above the bottom of the pan, so that the water must overflow this before it can pass away. In this manner particles of metal held in suspension in the water are deposited by settling in the pan.

It is surprising how much metal is recovered in this manner, and not only is it recovered but it is so cleaned that when dry it can be used with the new metal without being first run into ingots.

Two or three times a week the foundry floor should be swept. These sweepings should be sieved, and as the metal is what has been spilled, it is clean and therefore easily cared for. It may be examined to see that there are no nails in it, and then melted, by proportioning it amongst the new metal or running it into castings where the quality of the metal is unimportant. The dust from the emery wheel is the most difficult of all the waste to dispose of, as the emery dust is held in suspension when the metal is melted, rendering it unfit for all castings that have to be machined. A good way of dealing with it is to wait until enough has been accumulated, then mix it with sweepings and any other odds and ends of metal and run it into ferrules for plumbers.

In small foundries, employing two or three molders, it is unavoidable that they should have to cut and sieve their own sand, weight and shake out their own molds, pull their own pots, and even, in some instances, attend their own furnaces.

But in larger shops this is not necessary, as helpers can be engaged to do this work, leaving the molders with nothing to do but mold. Experience has taught that one helper can attend to four molders, keeping them supplied with sand, flasks, cores, powdered rosin for parting, and flour to dust on the mold, and with the assistance of his brother helpers, bringing up the metal, when ready,

and the result is an economy. If four molders keep one helper employed all his time it is evident that the work accomplished will be equal to what five molders would have done, because the molder is no faster at laboring work than the helper, especially after the helper has got accustomed to the thing. This being the case, there is saved the difference between the pay of the helper and a molder. If the molder is paid $2.50 per day and the helper $1.50, the difference is a dollar, which is saved on every four molders, or 25 cents a man, per day. In actual practice the saving is much greater than this, because the molder not being wearied by such exhausting labor as pulling out pots, weighting and dumping molds, can accomplish more work in a given time. Another saving may be effected by keeping good bottom boards on hand. Some founders seem to think these things will last forever. They forget that these boards are necessarily subjected to much rough usage, and are burnt and so weakened by the ignited gases escaping from the mold, and therefore cannot be expected to have a long life. There is often so much kicking about providing new ones that often the foreman gets afraid to ask for them, with the result that the molders, appreciating the situation, take chances, and so molds run out at the bottom and castings are lost through straining, and a dozen other things occur, causing loss, all traceable to the wornout bottom boards, so that in a short time the loss amounts to several times more than the cost of new boards, and the trouble continues until finally it reaches such a stage that new boards have to be provided. Other causes of loss might doubtless be mentioned, but if due attention is paid to the things just glanced at the leakage will be reduced to a minimum.

Centrifugal Casting.

The centrifugal casting method, patented by P. Huth, a civil engineer at Gelsenkirchen, Westphalia, Germany, is for the purpose of depositing different metals separately in a mold, and also, in the case of steel casting, to produce hard and soft parts in one casting. As regards a number of cast pieces this method is of the same importance in steel casting as the chilling method in iron casting. It is well known that hard iron castings are produced in a chill mold which, by the quick cooling of the fluid metal, prevents the segregation of the graphite from the iron. Soft cast steel does not possess even the tenth part of the carbon that is contained in cast iron, the use of a chill mold would, therefore, be without benefit. Now, in order to produce steel castings with hard and soft parts, the above method resorts to centrifugal force. If, for instance, into the rotating mold of a car wheel hard steel be poured first, this steel will be distributed along the circumference of the mold, and if the inner part be filled up with soft steel a wheel is obtained the body of which consists of soft steel with a hard band around it. The junction line between the two metals is plainly visible. The castings produced after this method are free from blow-holes, and even the thinnest castings come out perfectly.

As claimed by the inventor this method is of special benefit in the manufacture of milling and crushing machinery, pulleys, tooth and cog wheels, stamp mills, armor plates for vessels, and safes, brake shoes, rolls, etc. —American Manufacturer.

(As a theory, centrifugal casting may appear available in many instances, though we only know of one branch of founding where it is applied successfully. This is in the casting of small statuary, which is cored out in a novel manner. A certain amount of metal is put into the mold, mounted on trunnions, the gate is quickly plugged up and the mold rotated. The metal is here distributed to all parts of the mold by centrifugal force, and as it loses its fluidity, leaves an equal thickness all around. It has undoubtedly occurred to many molders in observing the thinness of such work that something out of the ordinary was employed in producing it. But it will readily be seen that the application of this centrifugal principle reaches its limit with comparatively small work.

In the above case, it will be observed that the whole mold is covered, while in the German method it is proposed to limit it to certain sections of the mold. It is here proposed, by rotating a car wheel mold, to deposit a steel rim along the circumference of the mold, and afterwards, when the rim becomes solid, to fill the interior with a softer metal. The theory may appear all right, but in practice it will be difficult to deposit the

first metal on the rim, and no place else. To tell the truth, we do not believe the method has been tried. Then, two metals cast one inside of another, have the bad habit of separating, and this we should think would condemn it as far as car wheels are concerned. —Ed.)

"A Rolling Stone Gathers no Moss."

I don't like the proverb-crank: he finds a proverb to fit every case, and is governed by the proverb instead of using analysis, mixed with horse sense. I am reminded of this by a young man who wants me to help him get a permanent position; says he has been "knocking around" for the past two or three years; that "a rolling stone gathers no moss." etc., etc. Now, just because a rolling stone gathers no moss, it does not follow that everything on the face of the earth that could be likened to a rolling stone, would not gather anything that could be likened to moss. I told this young man that the knocking around to which he objects, is the very thing he needs at his age to sharpen his wits and teach him to depend on himself. I do not know of a more pitiable sight than an old man who has always before had a permanent position, looking around after a job. Permanent positions do not always last, to use a Hibernianism, and when they end it is almost always when a man is too old to hustle around for another, even if he wasn't spoiled by having been in one place all his life.

There is no one shop, or office, or man, that knows it all. A young man cannot do better than to get an experience while he is young, and not the least important is the fact that he makes acquaintances while he is getting his experience. A very ordinary man who has an extensive acquaintance is much better equipped to fight the world than a better man who has always been in one place, and knows no one outside of the place. It is a good thing to have the experience of being "out of a job" while young, because, then, it doesn't crush a man to be out of a job when old, as he has been there before and he has his acquaintance. I do not mean that a man need not be competent if he has the acquaintance, but that, being competent, the acquaintance will help him to a new job when he loses the old one.

The man who has always been in one place is the man who dares not make a move without a precedent; he is the man who says: "What was good enough for my grandfather is good enough for me."

"Knock around" till you have a good experience and acquaintance, and if you lose a "soft thing," call it a special Providence for your future good. While in this period of your career, you will incidentally find out which branch of your business you are best fitted for, and will not (after you have the experience) make the mistake of taking the first position that offers, simply because it is a position, but will wait until the right position is open.

If you must be governed by proverbs, here is a sort of one that covers the case: "Don't be tied to anybody's apron-strings."—Machinery.

The Annual Outing of the Western Foundrymen's Association.

The few days, which the members of this association are in the habit of devoting yearly to becoming better acquainted with their neighbors and themselves, will be spent in Cincinnati this year, beginning with October 18. The secretary announces that interesting papers will be presented for discussion. Reduced railway and hotel rates have been obtained.

A Gold Mine.

This is "The Buffalo Enquirer's" recipe for transmuting other metals into gold: "Take (1) cold drawn seamless tubing, (2) tool-steel bearings, (3) hollow rolls of rubber, (4) piano wire, (5) second-growth hickory. Make the ingredients into a 822 bicycle and sell it for $100."

The Adams Company, of Dubuque, Iowa, have recently shipped to Moscow, Russia, one Farwell's Automatic Molding Machines, and one Farwell's Sand Press, which shows that even the conservative Russian is beginning to awake to the importance of securing improved appliances.

The Whiting Foundry Equipment Co. are about to open an eastern office in the Fidelity Building, Philadelphia, in order to more promptly reach their numerous customers in that part of the country with the full line of modern appliances manufactured by them. Geo. W. Borton has been selected as their representative.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than the 20th to insure publication.
Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

FOR SALE—No. 3 Root blower, used only a few months; to be replaced with largest size. Address Box 4, care THE FOUNDRY PUBLISHING CO.

WANTED—Position as foundry foreman. Eighteen years' experience on extra finish and plain hollow-ware and all kinds of machinery and job molding. Address Box 90, care of THE FOUNDRY.

FOR SALE—Good jobbing foundry, fitted with a 30" and 40" cupola, jib crane, blower, engine, boiler, etc.; molding floor, 80x90 feet. Good location in manufacturing district of Baltimore City, Md. Easy terms. Address "Q," box 92, care THE FOUNDRY, Detroit, Mich.

WANTED—An ambitious young foundryman with some experience and moderate capital to buy an interest in an old established foundry. Located in a live western city of 40,000 population. A splendid chance for the right man. References exchanged. Address "Standard," Box 87, care THE FOUNDRY.

FOR SALE—Foundry and machine shop at Des Moines, Iowa, fully equipped. Will sell the personal property and lease the real estate for a term of years with option. Des Moines is the largest and best city in the state for manufacturing. For particulars address S. D. WILSON, 219-23 East First St., Des Moines, Iowa.

WANTED—To correspond with a reliable party who can sell for us a stove and job foundry, situated in city of over thirty thousand people, and being the only plant of its kind there. A rare chance for a live capable person to make a liberal commission. Reference given and required. Address Estate, Box 89, care THE FOUNDRY.

A THOROUGHLY practical and well-known foundry manager would like to represent a first-class firm or firms in sale of foundry supplies in New England. Am steady, reliable, and have been a successful traveling salesman. Correspondence solicited from dealers in pig iron, coke, facings, supplies in general and labor-saving devices. References first-class. Address "Supplies," box 91, care THE FOUNDRY.

A Round Level.

The inventor calls this instrument very appropriately the "Which Way," since you don't have to turn this level around in order to find which way your work is out; you simply place it and it will tell you in an instant "Which Way" you are out. It is the size of a dollar and very convenient for

pocket use. It consists of an accurately ground concave lense, screwed to a steel base containing alcohol; is nicely nickle-plated and makes a fine appearance. The inventor and manufacturer, Mr. E. G. Smith, of Columbia, Pa., will be pleased to send descriptive circulars to anyone interested.

The Buffalo Forge Company have issued a pocket edition of their general catalogue, published in December last. Like the larger or library catalogue, it is replete with information that comes in handy at any hour of the day. It can be obtained upon application by anyone directly interested in the subjects of which it treats.

The latest metallurgical discovery to revolutionize the steel industry is a process of making from cast iron a steel which is remarkable in many ways. Probably the most wonderful property of the new material is that it is "positively anti-friction," and for this reason it is to be used for brakeshoes for locomotives and cars. At present cars have an unpleasant habit of stopping when the brake-shoes are applied to the wheels, on account of the friction generated. But with the new positively anti-friction brake-shoes, the cars will move serenely on. There will be no friction to stop them, and the shoes will not wear out, which is, of course, the main thing.—Exchange.